



Workshop Manual SpaceFox, Space Cross, Suran, Suran Cross, Sportvan 2006 ➤

4-cylinder fuel injection engine

Engine ID	BJA	BAH	BPA	BLH	CCR A	CFZA			
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Edition 05.2011





List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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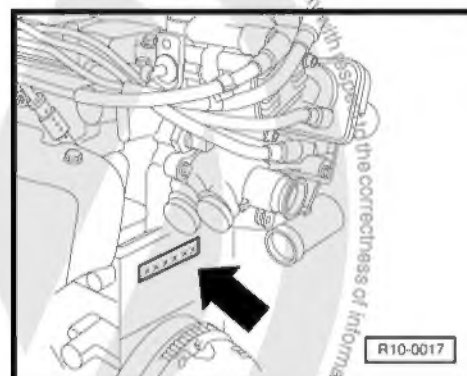
00 – Technical data

1 Technical data

1.1 Engine number

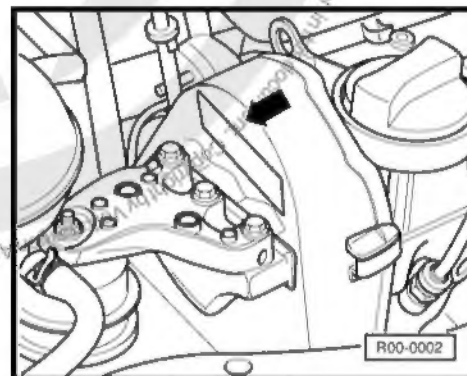
The engine number ("identification letters" and "serial number") are located on the engine block-arrow-, under the thermostatic valve housing.

The engine number consists of up to nine characters (alpha-numerical). The first part (no more than 3 identification letters) represents the "the engine identification letters", the second part (6 characters) is the "serial number". If more than 999,999 engines with the same identification characters are produced, the first of the six characters is replaced by a letter.



Additionally, on the mechanical distribution cover there is a sticker -arrow- showing "the engine identification letters" and "serial number".

Engine identification characters are also indicated on the vehicle data plate.



1.2 Engine characteristics

Engine identification letters	BAH (gasoline)	BLH (gasoline)	BJA (Total flex)	BPA (Total flex)	CCRA (Total flex)	CFZA (gasoline)
Production	08.03 ▶	09.03 ▶	08.03 ▶	10.04 ▶	04.08 ▶	11.08 ▶
Capacity cm ³	1599	1599	1599	1599	1598	1598
Power cv (kW) / (gasoline) rpm	101,0(74,0)/5750	101,0(74,0) / 5500	101,0(74,0)/5750	101,0 (74,0)/5750	101,0 (74,0)/5250	101,0 (74,0)/5250
Power cv (kW) / (alcohol) rpm	---	---	103,0(76,0)/5750	103,0 (76,0)/5750	104,0 (76,0)/5250	---
Torque Nm(mkgf)/ (gasoline) rpm	140,0(14,3)/3250	140,0(14,3) / 3250	140,0(14,3)/3250	140,0 (14,3)/3250	151,0 (15,5)/2500	143,0 (14,6)/2500
Torque Nm(mkgf)/ (alcohol) rpm	---	---	142,0(14,5)/3250	142,0 (14,5)/3250	153,0 (15,6)/2500	---
Bore ∅ mm	76,5	76,5	76,5	76,5	76,5	76,5
Stroke mm	87,0	87,0	87,0	87,0	87,0	87,0
Compression ratio	10,8:1	10,8:1	10,8:1	10,8:1	12,0:1	10,8:1
RON min.	91 lead-free	91 lead-free	alcohol or gasoline with 91 lead-free	alcohol or gasoline with 91 lead-free	alcohol or gasoline with 91 lead-free	91 lead-free
Injection, ignition	Bosch ME 7.5.10	Bosch ME 7.5.10 ²⁾	Bosch ME 7.5.10	Bosch ME 7.5.10 ¹⁾	Bosch ME 7.5.30 ⁶⁾	Bosch ME 7.5.30



Engine identification letters	BAH (gasoline)	BLH (gasoline)	BJA (Total flex)	BPA (Total flex)	CCRA (Total flex)	CFZA (gasoline)
Knock control	1 knock sensor	1 knock sensor	1 knock sensor	1 knock sensor	1 knock sensor	1 knock sensor
Self-diagnosis	yes	yes	yes	yes	yes	yes
Lambda regulation	1 probe	2 probe ³⁾	1 probe	1 probe	1 probe ⁵⁾	2 probe ⁴⁾
Catalyzer unit	yes	yes	yes	yes	yes	yes

1) ME 7.5.20 as of 09.2006.

2) ME 7.5.20 as from 02.2006.

3) Mexican version

4) 2 lambda probes only for the Argentinean version

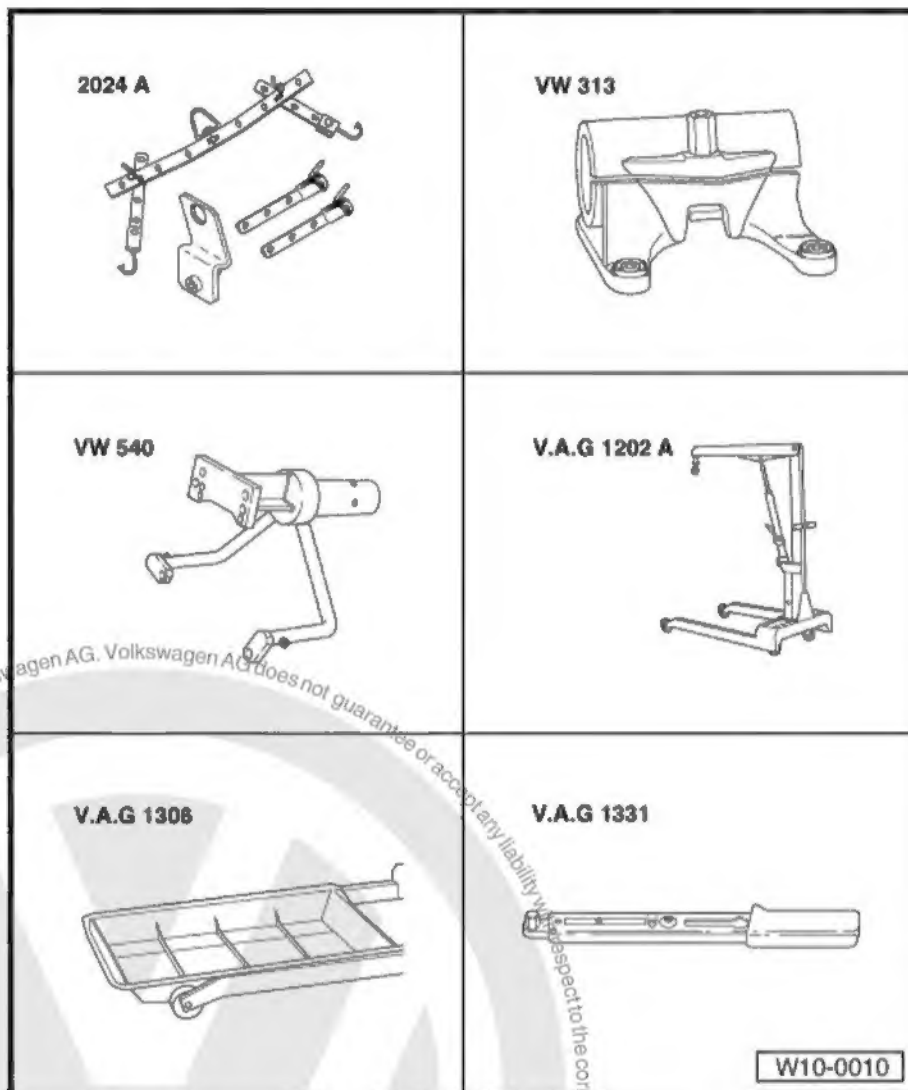
5) 2 lambda probes only for the version as from model-year 2011

6) 4GV for the SQ 200 transmission (gear selector mechanism)



10 – Cylinders, engine block, support, cover

1 Engine - remove and install



Special tools and workshop equipment required

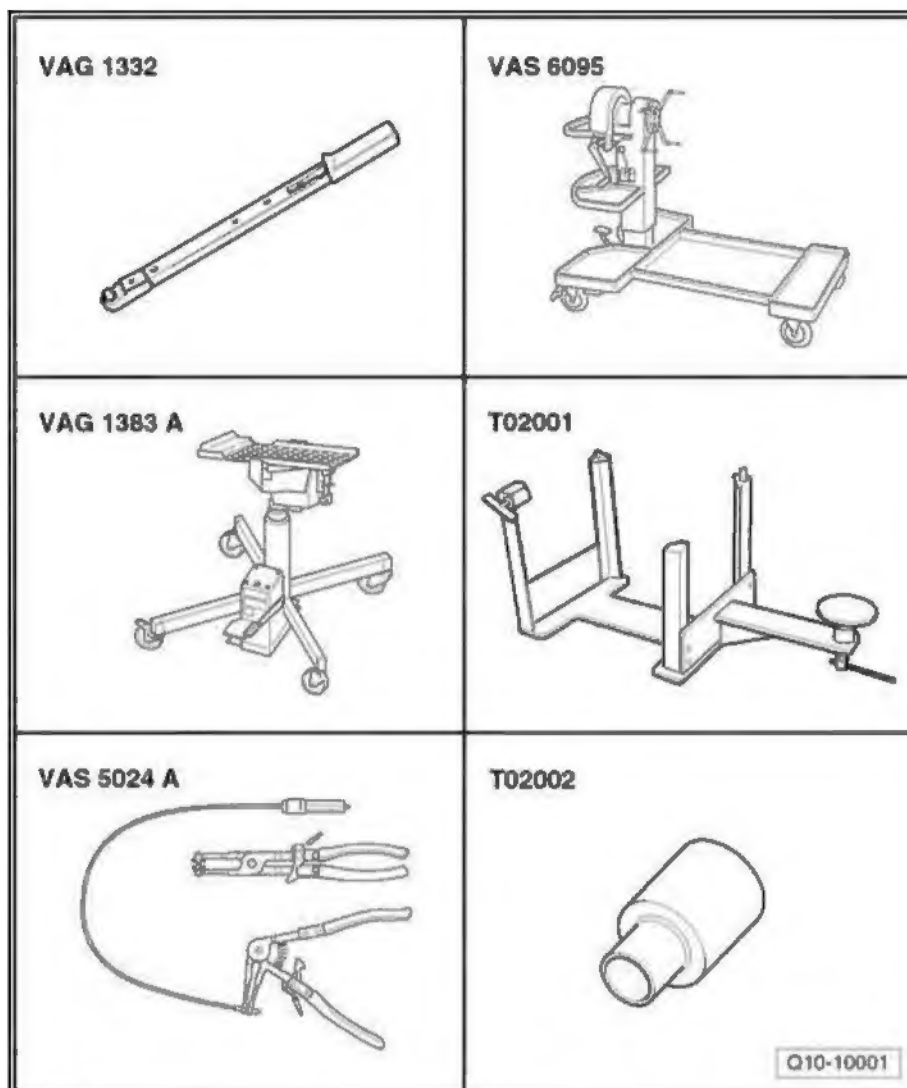
- ◆ Support bracket -2024A-
- ◆ Support -VW 540-
- ◆ Hydraulic hoist -VAG 1202A-
- ◆ Oil sump -VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331- .

No illustration:

- ◆ Hoisting eyelets No. of the replacement part: Support -030 103 390 F- (on the belt pulley side). Support -030 103 390 G- (on inertial flywheel side).
- ◆ Lubricating grease -G 000 100- (vehicles with manual transmission).
- ◆ Braces for cables.



- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-
- ◆ Support for VW643 or VW 643/1 -VW 313- or Rotary stand for engine and transmission -VAS 6095-
- ◆ Gearbox jack or engine + gearbox assembly jack or VAG 1383A -EQ 7081-
- ◆ Device -T02001-
- ◆ Standard-type clamp pliers -VW 5162 (VWB) - or - VAS 5024A- , or Standard-type clamp pliers -VAS 6340-
- ◆ 5 step ladder -VAS 5085-
- ◆ Adaptor sleeve -T02002-



1.1 Removal



WARNING

Release gear selector mechanism pressure ⇒ Manual/automatic transmission; Rep. Gr. 34 ; Drive, housing .



Note

Check whether the vehicle has a coded radio. If so, consult the anti-theft code before disconnecting the earth strap of Battery -A- .

- The engine is removed along with the transmission by way of the lower section of the vehicle.
- With the ignition switched off, disconnect the battery ground cable of Battery -A- .
- All cable clamps that open or break during the engine removal shall be replaced and installed on the same place when installing the engine.



- Remove the air filter casing → [page 144](#) .
- Remove the Battery -A- → Electrical system; Rep. Gr. 27 ; Starter, generator, battery .
- Remove Battery -A- -arrows- → Electrical system; Rep. Gr. 27 ; Starter, generator, battery .

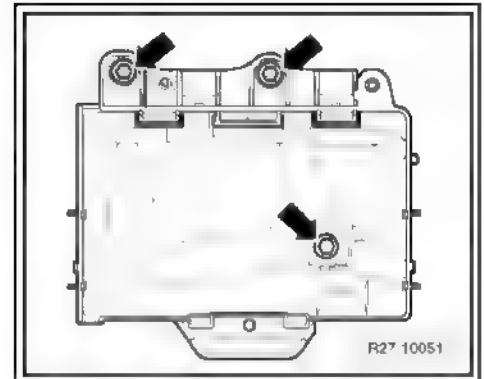
The cooling system is under pressure when the engine is hot. For this reason it is necessary to reduce pressure prior to any repairs.



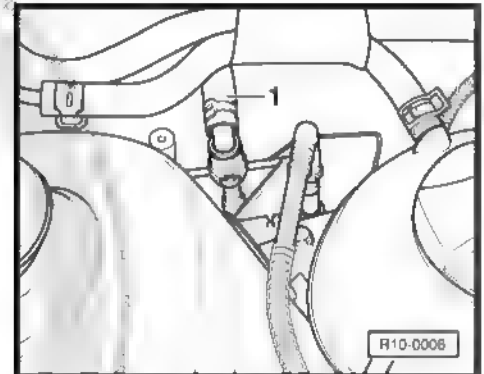
WARNING

Hot steam may escape while opening the coolant container, thus put a cloth over the cover to open it carefully.

The fuel supply hose is under pressure. Prior to loosening the hose junctions, place a cloth around them. Then eliminate the pressure by carefully removing the hose.

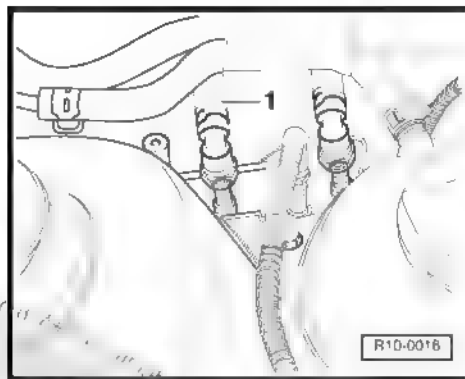


- Loosen fuel supply tubing -1- (press the release button). (BAH, BLH, and CFZA engines only).





- Loosen fuel supply tubing -1- (press the release button). (BJA, BPA, and CCRA engines only).
- Remove from The activated charcoal reservoir solenoid valve 1 -N80-, the connecting hose to the intake manifold.
- Seal the tubes to prevent dirt from entering the fuel supply system
- Respect cleaning rules ➔ [page 107](#) .
- Drain the cooling system ➔ [page 96](#) .
- Loosen transmission change mechanism; ➔ Manual/automatic transmission; Rep. Gr. 34 ; Drive housing (Manual transmission).
- Loosen clutch actuator cylinder; ➔ Manual/automatic transmission; Rep. Gr. 30 ; Clutch - control system (Manual transmission).



Note

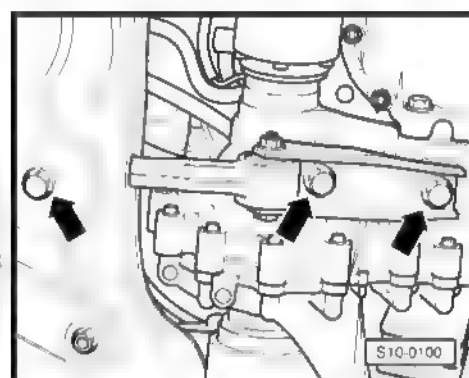
Clutch pedal must not be depressed.

- Disconnect or loosen the following components:
 - ◆ Remove power brake valve with the help of Pliers -AG3392- .
 - ◆ Hose of Cold start valve -N17- at throttle body.
 - ◆ Connector to Intake manifold pressure sender -G71- and Intake air temperature sender -G42- .
 - ◆ Connector to Ignition transformer -N152- , of Hall sender -G40- and of Throttle valve module -J338- .
 - ◆ Connector to Coolant temperature sender -G62- and Oil pressure switch -F1- .
 - ◆ Injection valve connectors.
 - ◆ Disconnect both front connectors of the gear selector mechanism and the rear connector of the electric motor.
 - ◆ Connector of Lambda probe -G39- .
 - ◆ Remove upper and lower hoses from the coolant reservoir of the cooling system.
 - ◆ Loosen upper radiator hose.
 - ◆ Remove expansion valve hoses ➔ Aeration system; Rep. Gr. 87 ; Air conditioning .
 - ◆ Remove the front wheels.
 - ◆ Remove left and right front wheel housing protectors.
 - ◆ Remove the lower engine compartment noise insulator ➔ Body - external mountings; Rep. Gr. 50 ; Body - Front part .
 - ◆ Loosen lower radiator hose.
 - ◆ Remove Poly-V belt ➔ [page 21](#) .
 - ◆ Remove the power steering oil pump and put it aside together with the hoses of ➔ Frame; Rep. Gr. 48 ; Steering .
 - ◆ Connector to Engine speed sender -G28- (intake manifold side).
 - ◆ 2-pole connector of Knock sensor 1 -G61- (intake manifold side).



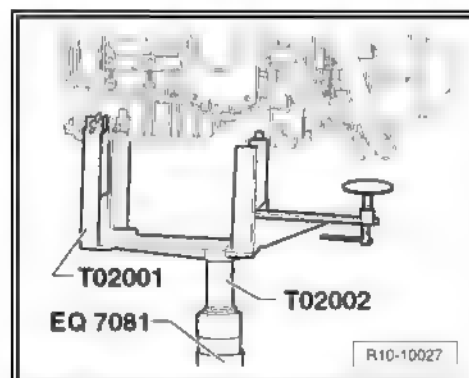
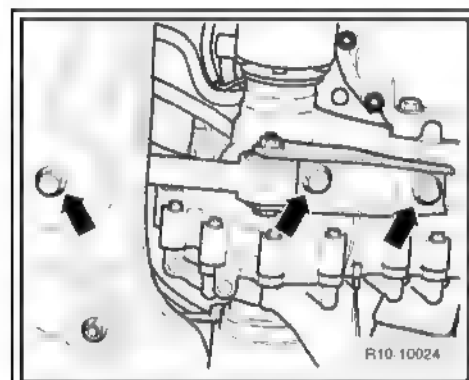
- ◆ Loosen engine wire harness from fasteners and rest harness on front panel.
- ◆ Remove/disconnect and loosen all electric transmission cables, Starter -B- Generator (Alternator) -C- and air conditioning compressor
- ◆ Disconnect negative transmission connection cable to front left hand longitudinal beam, at the beam.
- ◆ Disconnect the connector from the Lambda probe after catalytic converter -G130-
- ◆ Remove the front exhaust pipe. ⇒ **page 16.1**.
- Place front panel in service position ⇒ **Body - external mountings**, Rep. Gr. 50 ; Body - Front part .
- Remove the pendulum support -arrows-.

Vehicles produced until 12.09.07



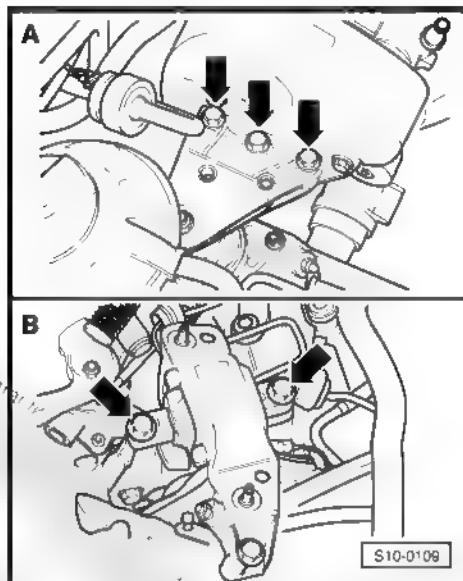
Vehicles produced as from 12.10.07

- Remove air conditioning compressor: ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning (without disconnecting hoses).
- Observe the additional notes and installation jobs ⇒ **page 15**.
- Remove the Generator (Alternator) -C- .
- Remove the anchorage support for the power steering hydraulic pump, Generator (Alternator) -C- and air conditioning compressor ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .
- Loosen right and left articulated shafts and secure them to the body ⇒ Frame; Rep. Gr. 40 ; Front suspension .
- Support engine and transmission by means of the Gearbox jack or engine + gearbox assembly jack or VAG 1383A -EQ 7081- , Device -T02001- and Sleeve -T02002- .
- Remove screws from transmission support -B- -arrows- and engine support -A- -arrows-.



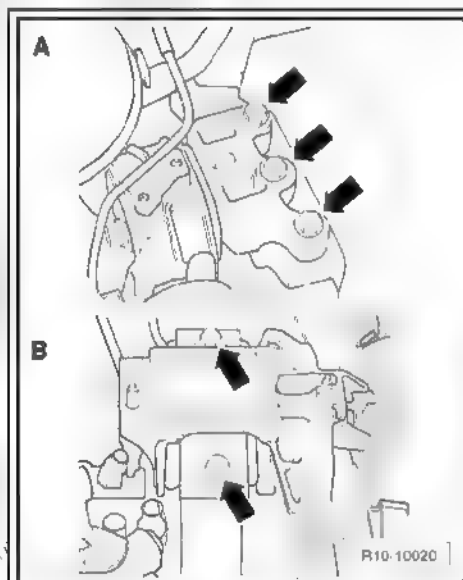


Vehicles produced until 12.09.07

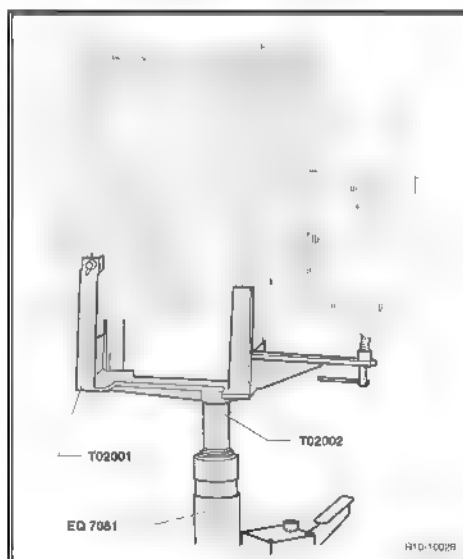


Vehicles produced as from 12.10.07

- Lower the assembly as much as necessary to clear it from the transmission mount, without causing interference between the gear selector mechanism and the universal joint.
- Move engine/transmission assembly forward.



- Remove engine/transmission assembly.
- Install hoisting eyelets on cylinder head. Tightening torque: 25 Nm.





- Secure with Support bracket -2024A- as described below, and lift slightly by means of the hoist

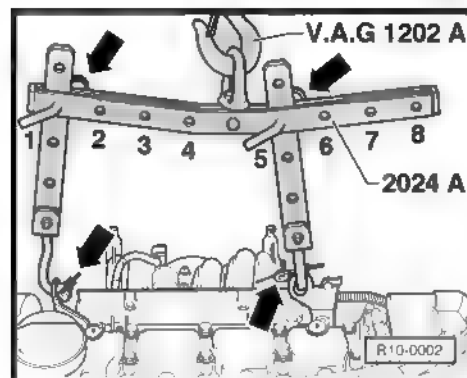
Pulley side: Position -3- of vertical rod. Support rod hole in position -1-.

Driving wheel side: Position -3- of vertical rod. Support rod hole in position -5-.



WARNING

On hooks and pins, use safety locks -arrows-



Note

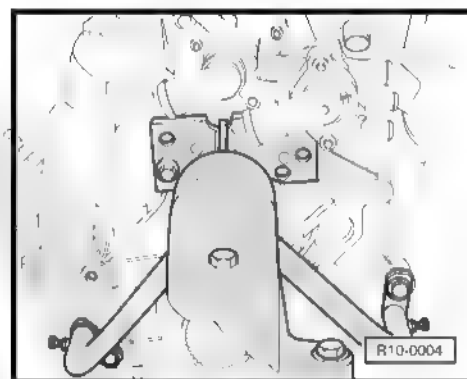
- ◆ *The positions numbered -1...8- of the suspension bar are pointing away from the pulley side.*
- ◆ *The holes on the support are counted from the hook.*

1.2 Engine - fix on the assembly support

To carry out the work, install the engine on the Support for VW643 or VW 643/1 -VW 313- or Rotary stand for engine and transmission -VAS 6095-.

1.2.1 Sequence of operations

- Separate gearbox from engine.
- Remove the inertial flywheel.
- Remove the intermediate plate.
- Secure the engine with Support for VW643 or VW 643/1 -VW 313- or Rotary stand for engine and transmission -VAS 6095-.



1.3 Installation

Installation happens in removal reversed order, observing the following.



WARNING

For installation work, especially in the engine compartment, due to reduced existing space, consider the following:

- ◆ *All hoses (e.g. fuel, hydraulic, activated charcoal filter system, coolant and refrigerant gas, brake fluid, vacuum) and electric cables must be arranged in a way to return to their original positions.*
- ◆ *Ensure easy access to all mobile parts or that may be hot.*

- Check the clutch bearing for wear and replace it, if necessary.
- Slightly lubricate the clutch bearing and the guide sleeve of the input shaft bearing with Grease -G 000 100-.
- If necessary, check the clutch disc centralization.
- Check if the gearbox and engine coupling guides are installed on the engine block and install them, if necessary.





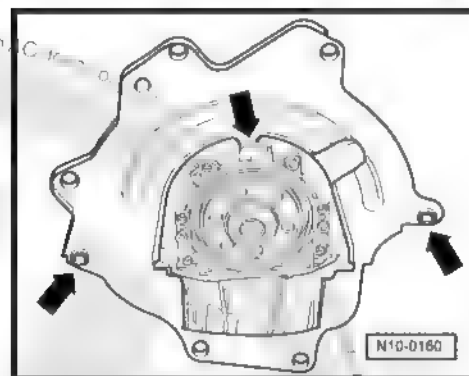
- Couple intermediate plate to sealing flange and move towards the sleeves -arrows-.
- When installing the aggregate, assure easy passage of gear selector mechanism and articulated shafts
- Align the engine and slightly move it so that the supports are tension-free.



Note

Tightening torque for engine brackets → [page 11](#) .

- Install articulated shaft: ⇒ Frame; Rep. Gr. 40 ; Front suspension .
- Install the air conditioning compressor ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .
- Install Poly V belt ⇒ [page 21](#) .
- Electric connections and their position: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- Install hydraulic clutch actuator cylinder: ⇒ Manual/automatic transmission; Rep. Gr. 30 ; Clutch - control system (manual transmission).
- Install shift command: ⇒ Manual/automatic transmission; Rep. Gr. 34 ; Drive, housing (manual transmission).
- Install front exhaust pipe on exhaust manifold ⇒ [page 161](#) .
- Install lower engine compartment noise insulator.
- Fill cooling system.
- Remove hoisting eyelets from cylinder block.
- Connect cooling system tubing to cylinder head. Tightening torque: 25 Nm.
- Install air cleaner assembly ⇒ [page 144](#)
- Adjust Engine control unit -J623- to Throttle valve module - J338- ⇒ [page 158](#) .
- Perform basic clutch and gear lever initial position adjustments and check the fault memory⇒ Vehicle diagnosis, testing and information system VAS 5051.
- Perform test drive and check fault memory ⇒ [page 158](#) .



1.4 Tightening torque

Location		Tightening torque
Screws, nuts	M 6	10 Nm
	M 8	20 Nm
	M 10	45 Nm
	M 12	60 Nm
Exhaust pipe in exhaust manifold		40 Nm



Note

Aggregate housing tightening torque → [page 13](#) .



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

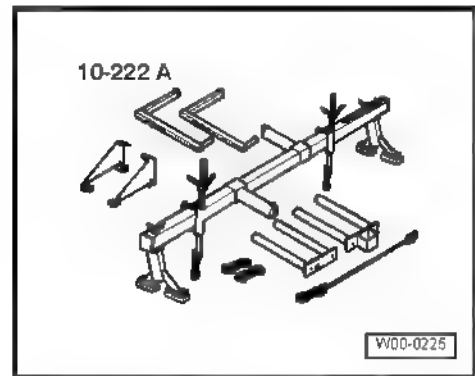
1.5 Engine and transmission bracket set - align

Receiving device -10-222 A- showing Installation device -10-222 A/1- or the Adapter -T02007- .



WARNING

Before loosening the screws, support the accessories with Bracket or VW 061 -10-222A- .



1.5.1 Powerplant supports, engine

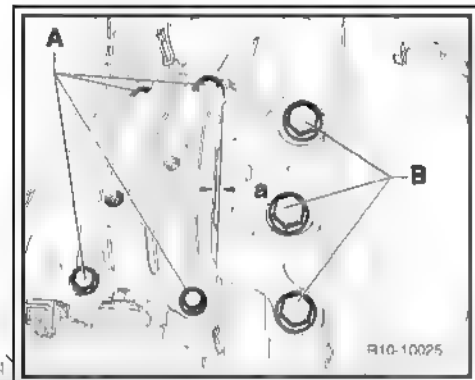
-nd- = 3.0 mm

- When installing the new -A- and -B-screws, to keep the assembly from moving, first insert all bolts and then tighten them with a torquemeter and, at the end, with an angular torque power cable.



Note

Fixation screws -B- for the transmission support: on applying final torque, take special care not to move the assembly.





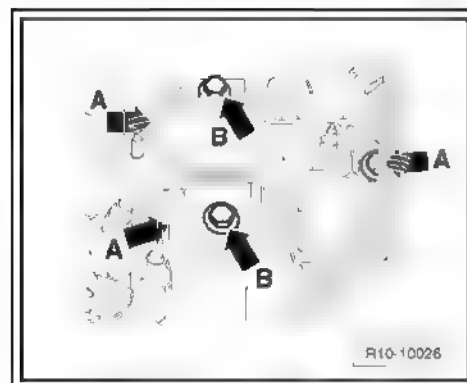
1.5.2 Powerplant supports, transmission

- When installing the new -A- and -B-, to avoid the assembly to move, prior "place" all screws and apply the torque with the torque wrench and, at the end, with an angular torque power cable



Note

Fixation screws -B- for the transmission support, on applying final torque, take special care not to move the assembly



Note

Engine assembly support fastening screws are self-locking screws and should always be renewed.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1.6 Drive train supports (torques)



Note

Engine assembly support fastening screws are self-locking screws and should always be renewed.

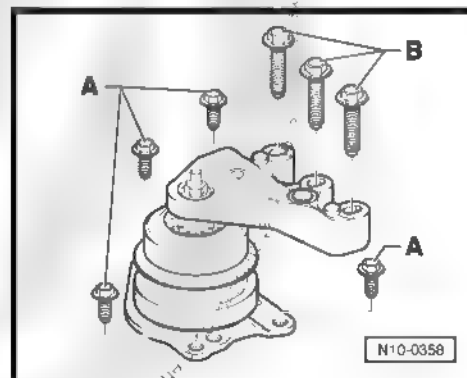


WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1.6.1 Powerplant supports, engine

Vehicles produced until 12.09.07





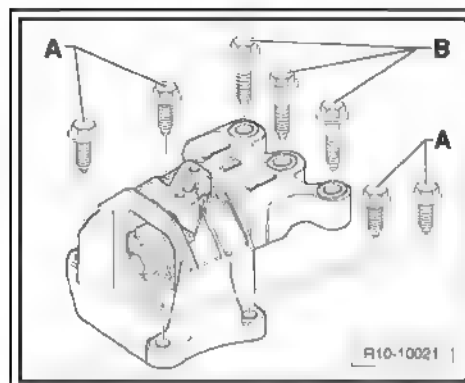
Vehicles produced as from 12.10.07

A⁷⁾ = 20 Nm + 90°

B⁷⁾ = 30 Nm + 90°

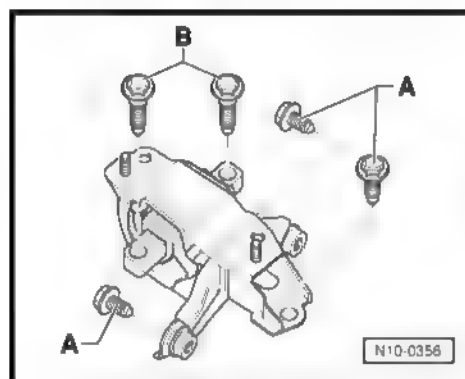
7) Replace

- When installing the new -A- and -B-, to avoid the assembly to move, prior "place" all screws and apply the torque with the torque wrench and, at the end, with an angular torque power cable.



1.6.2 Powerplant supports, transmission

Vehicles produced until 12.09.07



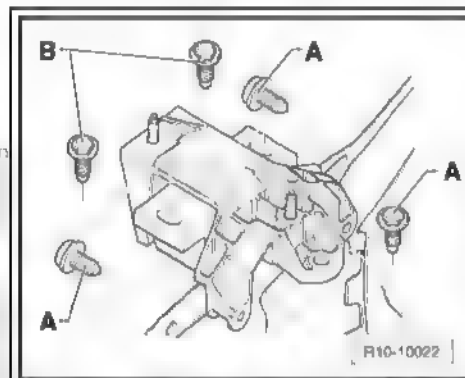
Vehicles produced as from 12.10.07

A⁸⁾ = 50 Nm + 90°

B⁸⁾ = 40 Nm + 90°

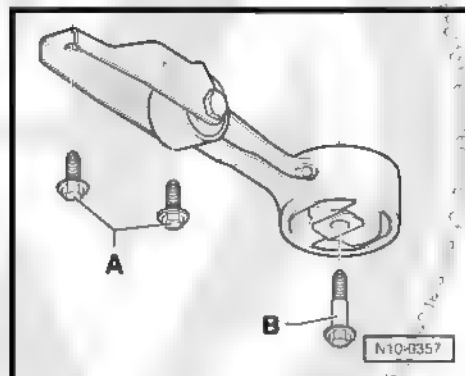
8) Replace.

- When installing the new -A- and -B-, to avoid the assembly to move, prior "place" all screws and apply the torque with the torque wrench and, at the end, with an angular torque power cable.



1.6.3 Pendulum support

Vehicles produced until 12.09.07





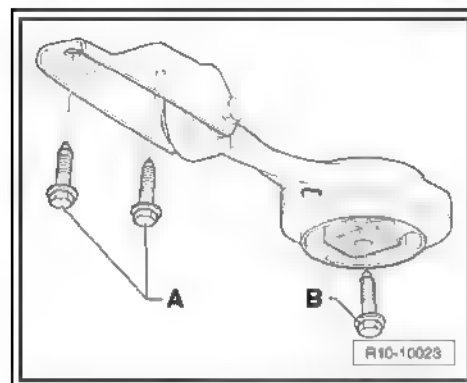
Vehicles produced as from 12.10.07

A⁹ = 30 Nm + 90°

B⁹ = 40 Nm + 90°

9) Replace.

- When installing the new -A- and -B-, to avoid the assembly to move, prior "place" all screws and apply the torque with the torque wrench and, at the end, with an angular torque power cable



1.7 Additional indications related to installation



WARNING

Do not open the air conditioning refrigerant gas circuit.

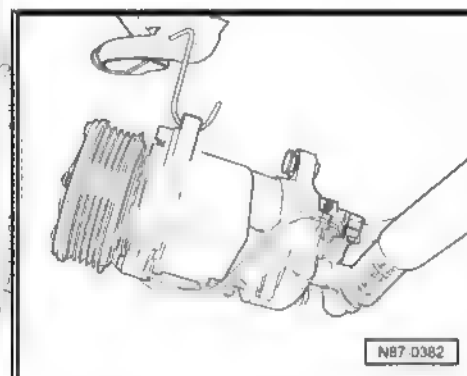


Note

In order to prevent damages to the condenser and refrigerant gas hoses, do not fold, twist or excessively stretch the hoses.

In order to remove and install the engine without opening the refrigerant gas circuit:

- Remove the refrigerant gas hose clamp(s).
- Remove Poly V belt ⇒ [page 21](#).
- Place front panel in service position ⇒ Body - external mountings; Rep. Gr. 50 ; Body - Front part .
- Move radiator and condenser panel forward to avoid stretching the refrigeration gas hoses.
- Remove air conditioning compressor⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .
- Attach the compressor to the bodywork in such a way that the refrigerant gas tubes and hoses are not subject to stress.





13 – Crankshaft, pistons

1 Engine - disassemble and assemble



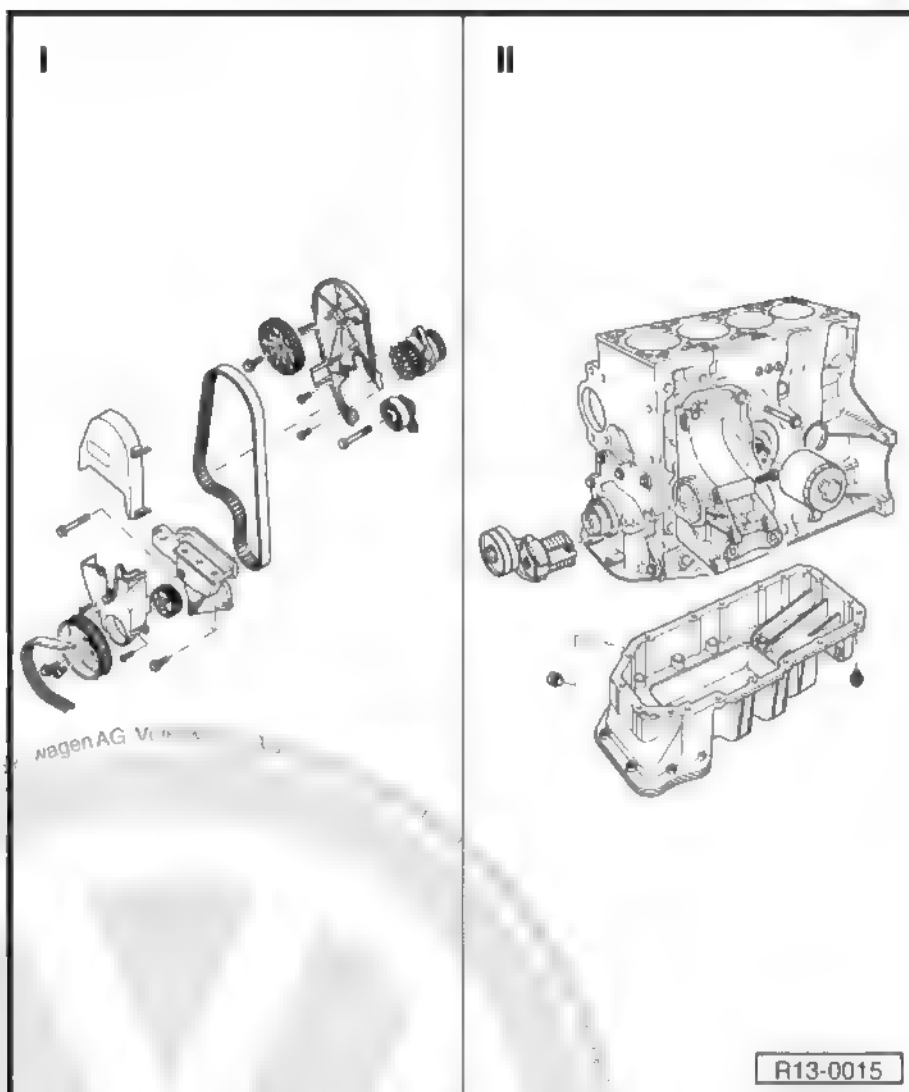
Note

- ◆ *In order to perform assembly work, attach the engine to the assembly support using Support for VW643 or VW 643/1 -VW 313- or Rotary stand for engine and transmission -VAS 6095- .*
- ◆ *If significant amounts of metallic particles, and particles resulting from wear, abrasion or bending (of bearing shells or conrods), are noticed in the oil when repairing engine, a careful cleaning of oil passages must be performed, in addition to replacing the oil filter.*
- ◆ *Prior to the assembly work, it is necessary to lubricate the support and slide surfaces.*



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.



I ⇒ [page 17](#)

II ⇒ [page 19](#)

Part I



1 - Upper cover of mechanical distribution system

2 - Toothed belt

- ☐ Mark turning direction before removal.
- ☐ Check for wear.
- ☐ Do not fold.
- ☐ Remove, install and adjust → [page 52](#) .

3 - 20 Nm + 90°

- ☐ Renew each time after removing.
- ☐ To tighten and to loosen, lock the camshaft gear with Retainer -3036- .

4 - Camshaft gear

- ☐ Observe fastening during installation.
- ☐ Observe the installation position of the toothed belt → [page 52](#) .

5 - 10 Nm

- ☐ Apply the Adhesive - D000 600 A2- .

6 - Rear cover of the mechanical distribution

7 - Water pump

- ☐ Renew gasket, if damaged.
- ☐ In case of damage and leakage, replace the complete pump and the seal.
- ☐ Ensure easy rotation.
- ☐ Removal and installation → [page 102](#) .

8 - Tensioner belt of the tensioner pulley

- ☐ Check → [page 49](#) .
- ☐ Toothed belt: remove, install and adjust → [page 52](#) .

9 - 20 Nm

10 - 20 Nm

11 - Engine support

12 - Crankshaft gear

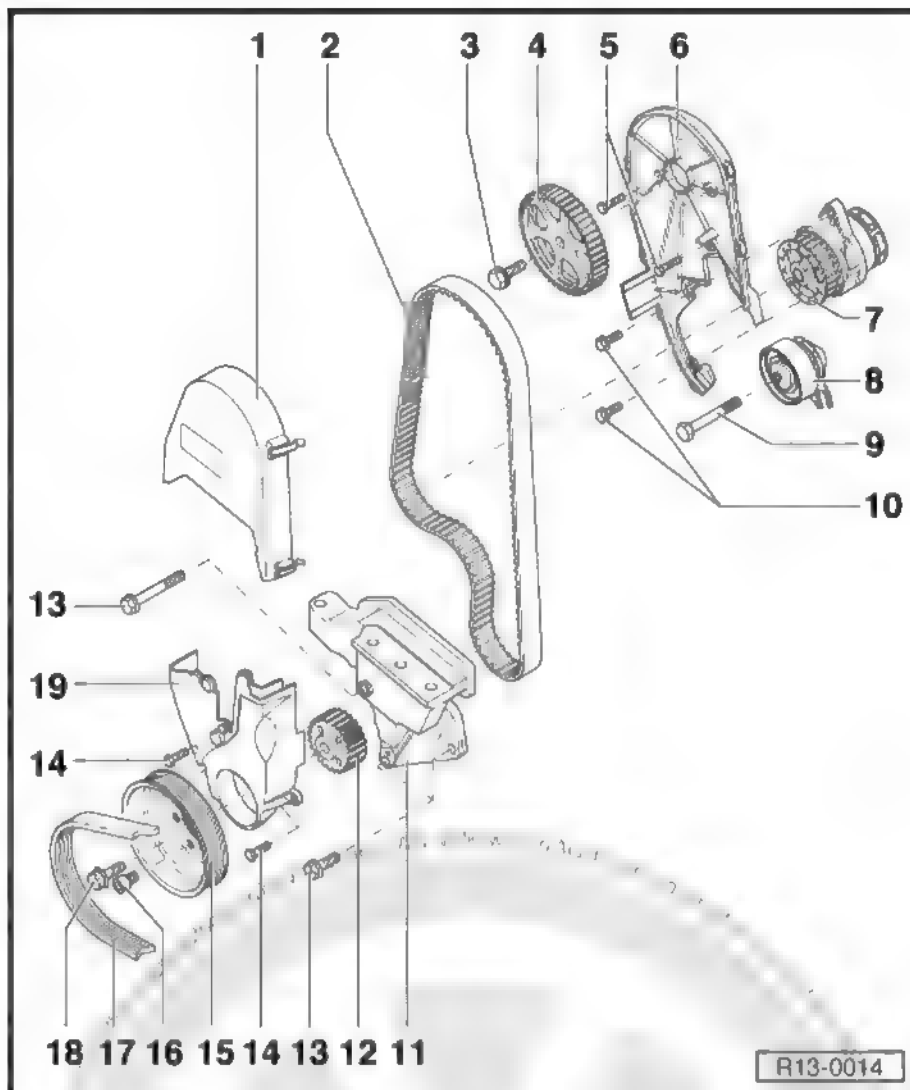
- ☐ Observe installation position of toothed belt → [page 52](#) .

13 - 50 Nm

14 - 10 Nm

15 - Crankshaft pulley

- ☐ Observe fastening during installation.
- ☐ Removal and installation → [page 52](#) .
- ☐ Remove and install Poly-V belt → [page 21](#) .





16 - 20 Nm

17 - Poly-V belt

- ☐ Mark turning direction before removal.
- ☐ Remove and install Poly-V belt → [page 21](#) .
- ☐ Poly-V belt run → [page 23](#) .

18 - 90 Nm + 90°

- ☐ Renew each time after removing.
- ☐ To loosen and tighten, use Wrench -3415- .
- ☐ Tightening may proceed in several stages.
- ☐ The angular torque can be measured with a regular angle measuring disc, e.g. Hazet 6690.

19 - Mechanical distribution lower cover

Part II



Note

*Clutch repairs: ⇒ Manual/automatic transmission; Rep. Gr. 30 ;
Clutch - control system .*



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.



1 - Engine block

- ☐ Remove and install the crankshaft
→ [page 39](#) .
- ☐ Remove and install pistons and rods
→ [page 42](#) .

2 - 50 Nm

- ☐ Tightening sequence
Tighten upper right bolt first, then lower right bolt and left bolt last (viewed from the front, in vehicle movement direction).

3 - Oil filter

- ☐ Release through the hexagon.
- ☐ Tighten manually.
- ☐ Observe the oil filter installation instructions.

4 - M 8: Tighten to 20 Nm + 90°, M 10: 45 Nm

- ☐ Renew each time after removing.

5 - 10 Nm + 90°

- ☐ Renew each time after removing.
- ☐ Release the oil sump fixing screws of the engine block on the pulley side (4 units) inside the oil sump.

6 - Oil sump

- ☐ Two parts.
- ☐ Clean all sealing surfaces before installation.
- ☐ Install with Silicon engine seal -D 176 404 A2- .
- ☐ Remove the oil sump cover for removal and installation.
- ☐ Removal and installation → [page 81](#) .

7 - Oil draining plug

- ☐ 30 Nm
- ☐ With integrated sealing ring.
- ☐ Replace.

8 - Compact support

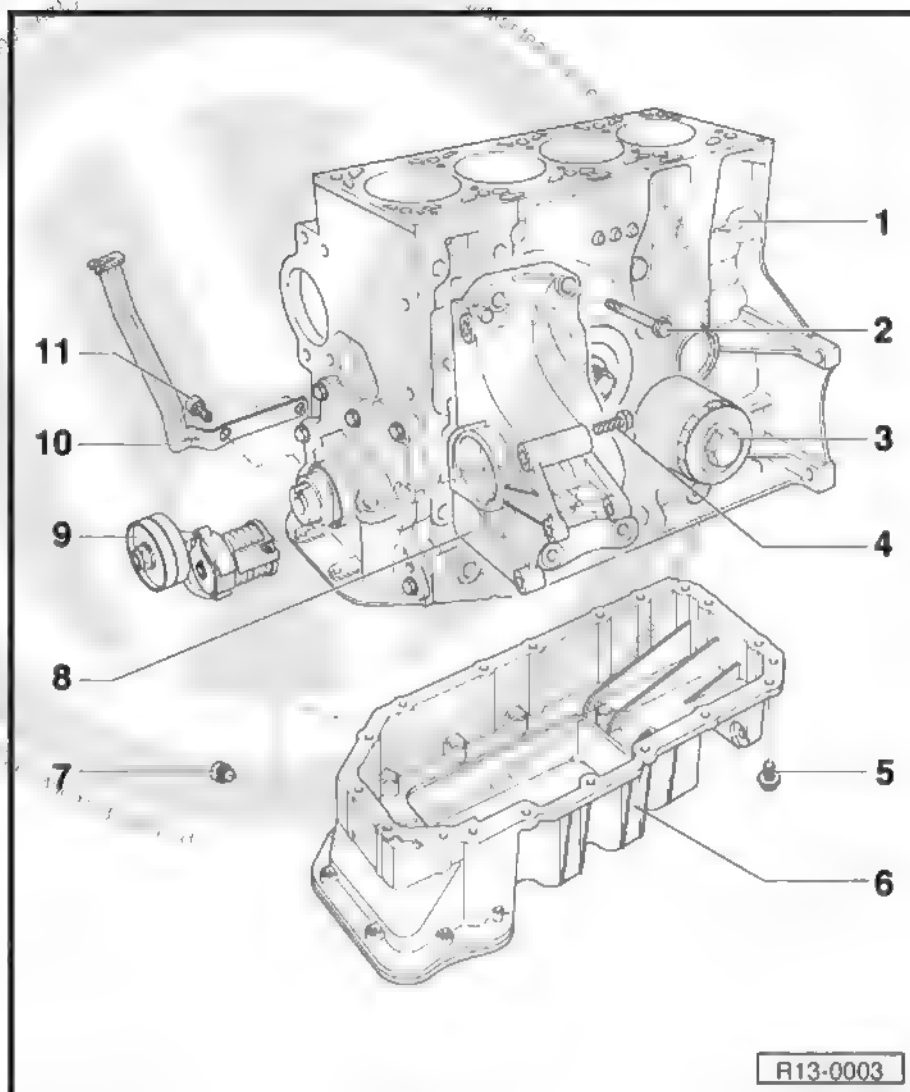
- ☐ For Generator (Alternator) -C- , air conditioning compressor, power steering oil pump, and fastening element for Poly-V belt.
- ☐ Remove and install compact support: → Aeration system; Rep Gr. 87 , Air conditioning .

9 - Tensioner pulley

- ☐ For Poly-V belt.
- ☐ Not applied to the Poly-V (elastic) belt.
- ☐ To loosen the Poly-V belt, turn with a 16 mm wrench.
- ☐ Remove and install Poly-V belt → [page 21](#) .

10 - Support

- ☐ For insertion connectors



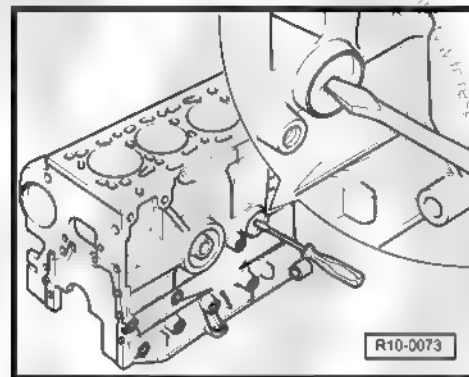


11 - 40 Nm

1.1 Seal cover - replace

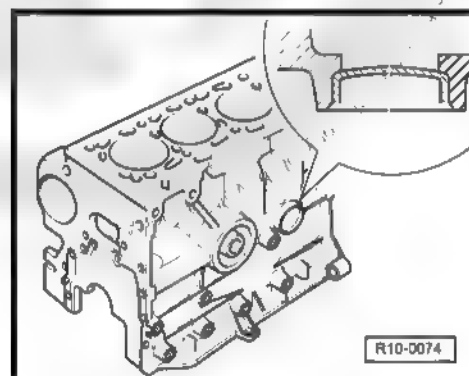
1.1.1 Removal

- Removal must be done with a screwdriver after previous boring by chisel.



1.1.2 Installation

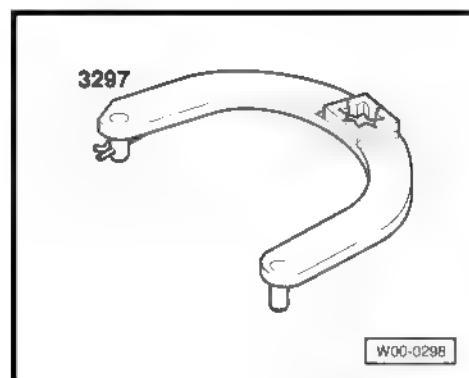
- Insertion by driftpin of cover diameter and depth to be maintained according to chamfer height. Apply glue during installation ⇒ Chemical Materials Manual.



1.2 Poly-V belt - remove and install

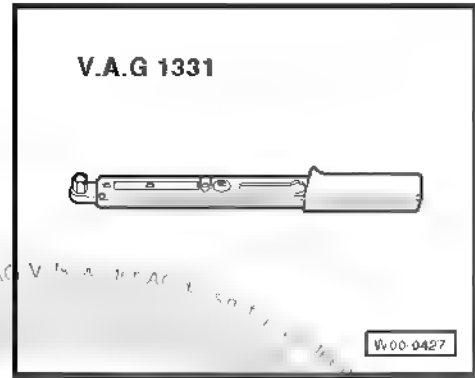
Special tools and workshop equipment required

- ◆ 16 mm screwdriver
- ◆ Lever -3297- or Compressor -VW 5329/7- -VW 5329/7-



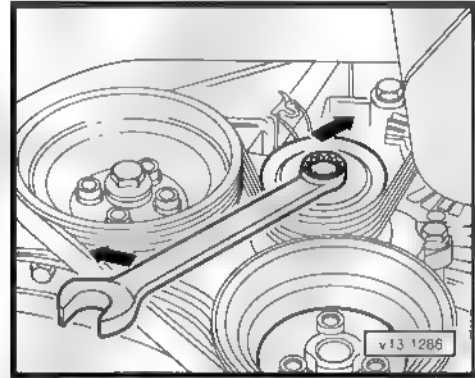


- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-



1.2.1 Removal

- Remove lower engine compartment anti-noise
- Mark the turning direction of the Poly V belt.
- Rotate belt tensioner in direction of -arrow-, with the 16 mm screwdriver and remove the belt.



1.2.2 Installation



Note

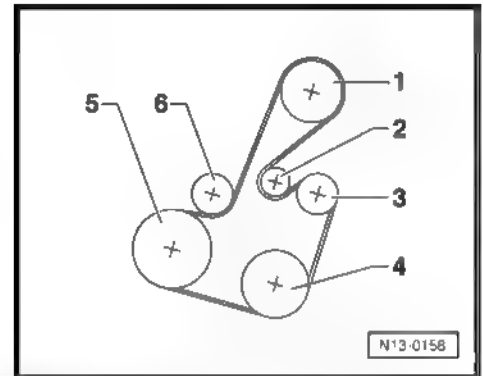
- ◆ *Before installing the Poly-V belt, make sure all aggregates Generator (Alternator) -C-, air conditioning compressor are properly installed.*
 - ◆ *During the installation of Poly V belt, observe the correct turning direction and proper seating of the belt on the pulley.*
 - First assemble the Poly-V belt to the crankshaft pulley. Then place the pulley on the tensor.
- Install in reverse order to removal.
- After finishing the work, always:
- Start the engine and check the movement of the belt



1.2.3 Poly-V belt run

Poly-V belt routing (regular)

- 1 - Hydraulic steering oil pump pulley
- 2 - Return pulley
- 3 - Generator (Alternator) Generator (Alternator) -C-
- 4 - Air conditioning compressor pulley
- 5 - Crankshaft pulley
- 6 - Tensioner pulley



Poly-V belt routing (elastic belt)

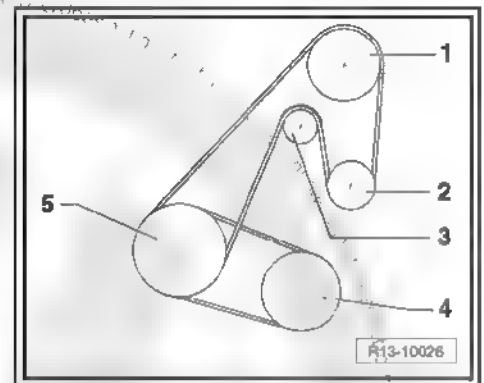
Power steering oil pump pulley.

Generator (Alternator) Generator (Alternator) -C-.

Reversing pulley.

Air conditioning compressor pulley.

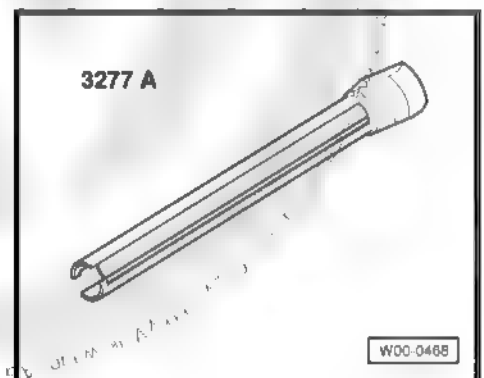
Crankshaft pulley.



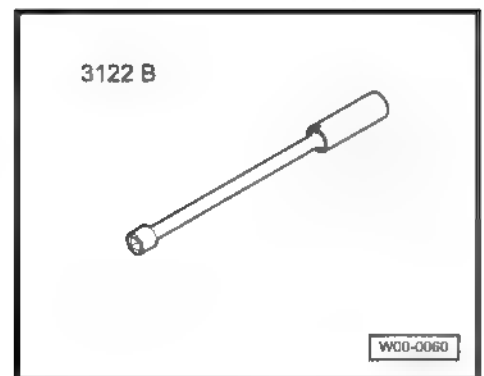
1.3 Poly-V belt (elastic) - remove and install

Special tools and workshop equipment required

- ◆ Assembly tool -3277 A- or Assembly tool -T10029-

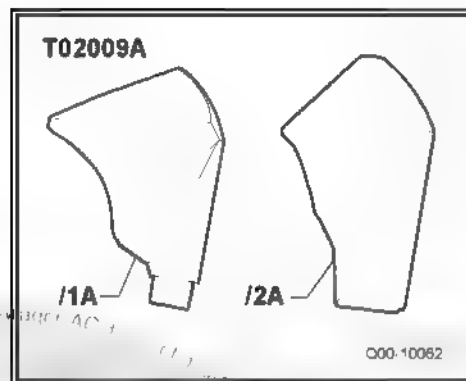


- ◆ Plug spanner -3122B-



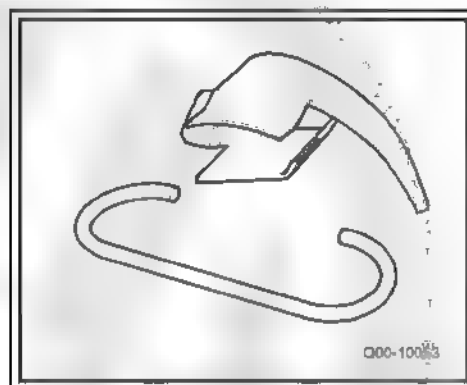


◆ Extractor -T02009A-



◆ Assembly tool

◆ Hook



Note

- ◆ Belt installation tools will be supplied with replacement belts.
- ◆ For larger belts, the mounting tool, and for smaller belts (air conditioning compressor), additionally, the hook.
- ◆ When removing belts, be sure to mark rotation directions which must be observed on reinstallation.

Poly-V belt (elastic) for Generator (Alternator) -C- power steering oil pump

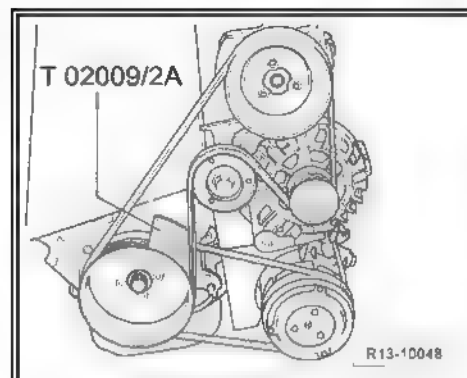
1.3.1 Removal

- Remove spark plug connectors with the help of Assembly tool -3277 A- or Assembly tool -T10029- .
- Remove Spark plugs -Q- with the Plug spanner -3122B- .
- Remove right front wheel case cover ⇒ Body - external mountings; Rep Gr. 66 ; External equipment

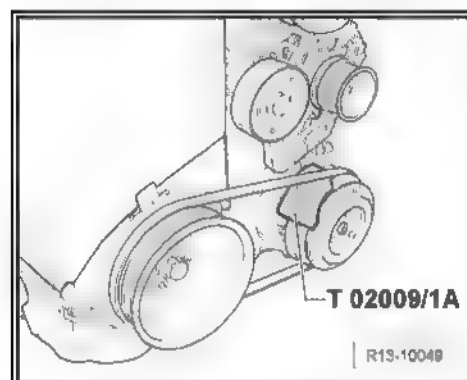


- Install the Extractor -T02009/2A- between the Poly-V belt to the crankshaft pulley
- Slowly turn the crankshaft clockwise until Extractor -T02009/2A- starts moving the belt
- Remove cover together with Extractor -T02009/2A- .

Air conditioner compressor Poly-V belt (elastic)



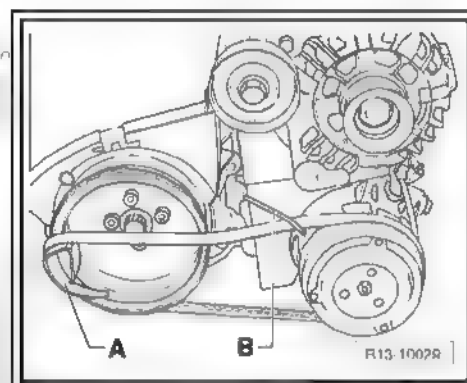
- Install the Extractor -T02009/1A- between the Poly-V belt and the air conditioner's compressor pulley.
- Slowly turn the crankshaft clockwise until the belt moves together with Extractor -T02009/1A- .
- Mark the belt operating direction.



1.3.2 Installation

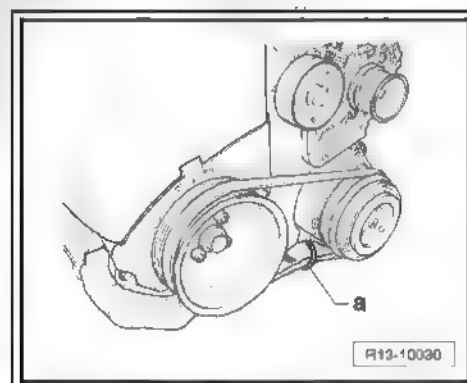
Air conditioner compressor Poly-V belt (elastic)

- Install Poly-V belt (elastic), obeying the work position on the air conditioner compressor pulley and the crankshaft, together with Assembly tool -A-.
- Install the Hook -B- on the upper part of the Poly-V belt.
- Slowly turn the crankshaft clockwise until the Poly-V belt has been completely installed.
- Remove the Assembly tool and Hook .



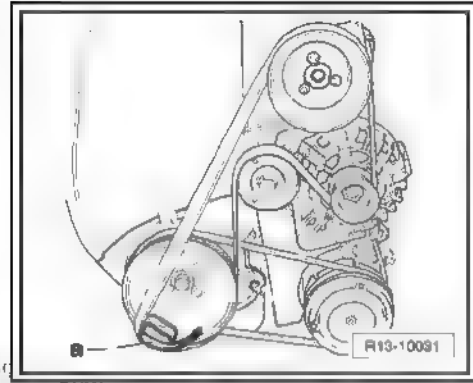
- Install the Hook -A- on the lower part of the Poly-V belt.
- Slowly turn the crankshaft clockwise until the Poly-V belt has been completely installed
- Take care for the Poly-V belt to be perfectly installed on the crankshaft and air conditioner compressor pulleys.
- Remove the Hook -A- on the lower part of the Poly-V belt

Poly-V belt (elastic) for Generator (Alternator) -C- power steering oil pump



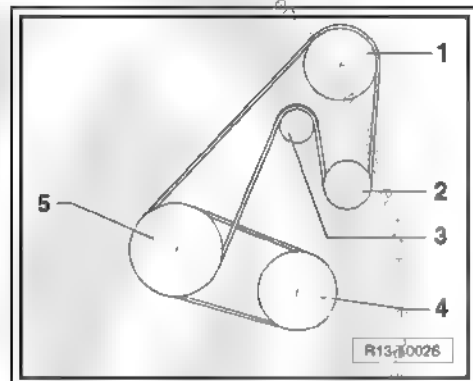


- Install the Poly-V belt on the pulleys of Generator (Alternator) -C-, power steering oil pump, return and crankshaft together with Assembly tool -A-.
- Slowly turn the crankshaft clockwise until the Poly-V belt has been completely installed
- Take care for the Poly-V belt to be perfectly installed on the crankshaft pulleys, Generator (Alternator) -C- and power steering oil pump.
- Install the right front wheelhouse protection ⇒ Body - external mountings; Rep Gr. 66 , External equipment .
- Install the claws from the Spark plugs -Q- with the Plug spanner -3122B- .
- Install spark plug connectors with the help of Assembly tool -3277 A- or Assembly tool -T10029-



1.3.3 Poly-V elastic belt route

- 1 - Power steering oil pump pulley.
- 2 - Generator (Alternator) Generator (Alternator) -C- .
- 3 - Reversing pulley.
- 4 - Air conditioning compressor pulley.
- 5 - Crankshaft pulley.





2 Sealing flanges and flywheel - Remove and install



Note

Clutch repairs: ⇒ Manual/automatic transmission; Rep. Gr. 30 ;
Clutch - control system .



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1 - 10 Nm

2 - Intake duct

3 - Engine block

- ☐ Crank shaft: remove and install ⇒ [page 39](#) .
- ☐ Piston and rod: remove and install ⇒ [page 42](#) .

4 - Knock sensor 1 -G61-

5 - 20 Nm

- ☐ The tightening torque influences the operation of Knock sensor 1 - G61- .

6 - 60 Nm + 90°

- ☐ Renew each time after removing.

7 - Flywheel

- ☐ In order to remove and install the flywheel, immobilize it with Latch -3067- .

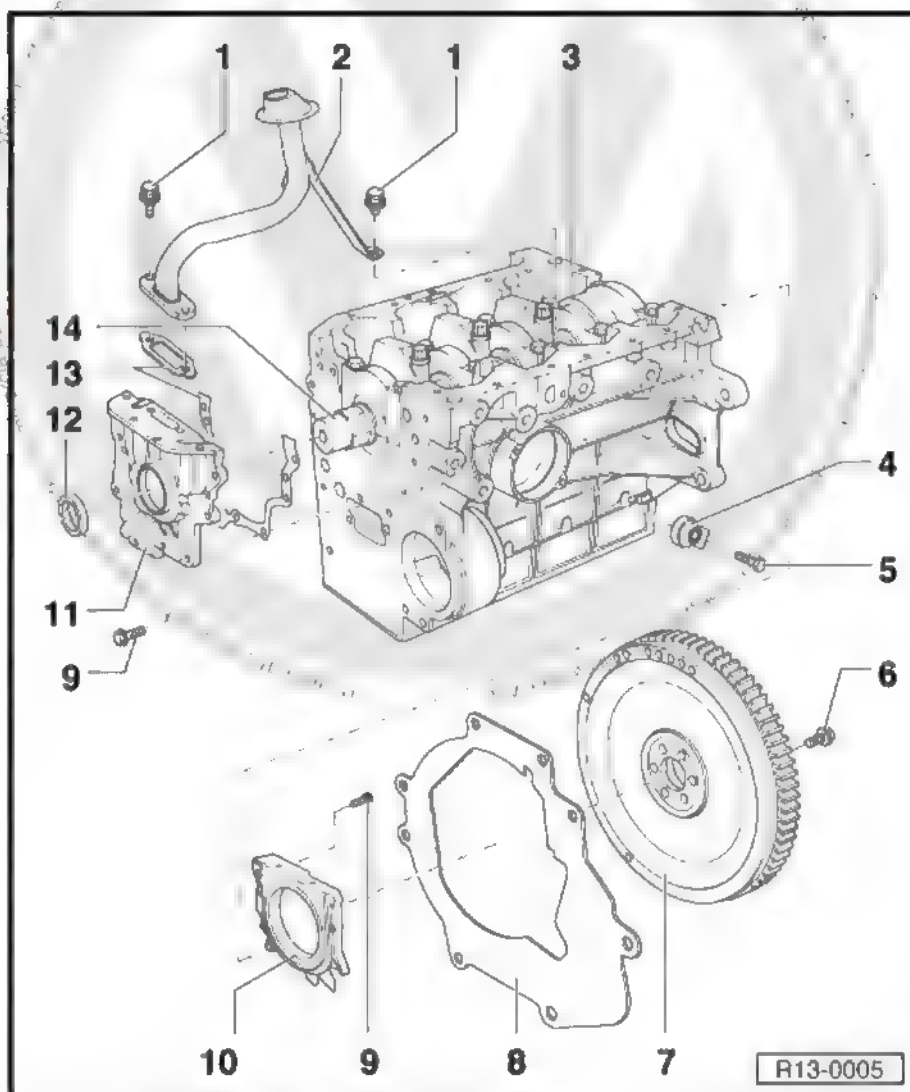
8 - Intermediate plate

- ☐ Must be properly seated on coupling guides.
- ☐ Do not damage/warp during installation.

9 - 10 Nm

10 - Crankshaft flange (flywheel side) with the rotor of Engine speed sender -G28- and sealing ring

- ☐ Always replace the full set with the seal ring and the rotor of Engine speed sender -G28- .
- ☐ Use the support sleeve provided for installation.
- ☐ To remove and install, the oil sump must be removed.
- ☐ Do not lubricate or apply oil to the seal lip of the seal ring
- ☐ Prior to installation, remove oil residues from the crankshaft journal with a clean cloth





- ☐ The support sleeve may be removed only after moving the flange on the crankshaft journal.
- ☐ Remove and install the flange ➔ [page 31](#) .

11 - Crankshaft flange/oil pump

- ☐ Replace complete set only
- ☐ Must be seated on the guide pins.
- ☐ To remove and install, the oil sump must be **removed**.
- ☐ Pay close attention to the crankshaft journal during installation ➔ [Item 14 \(page 28\)](#) .
- ☐ Remove and install the oil pump ➔ [page 84](#) .

12 - Crankshaft seal

- ☐ Replace ➔ [page 28](#) .

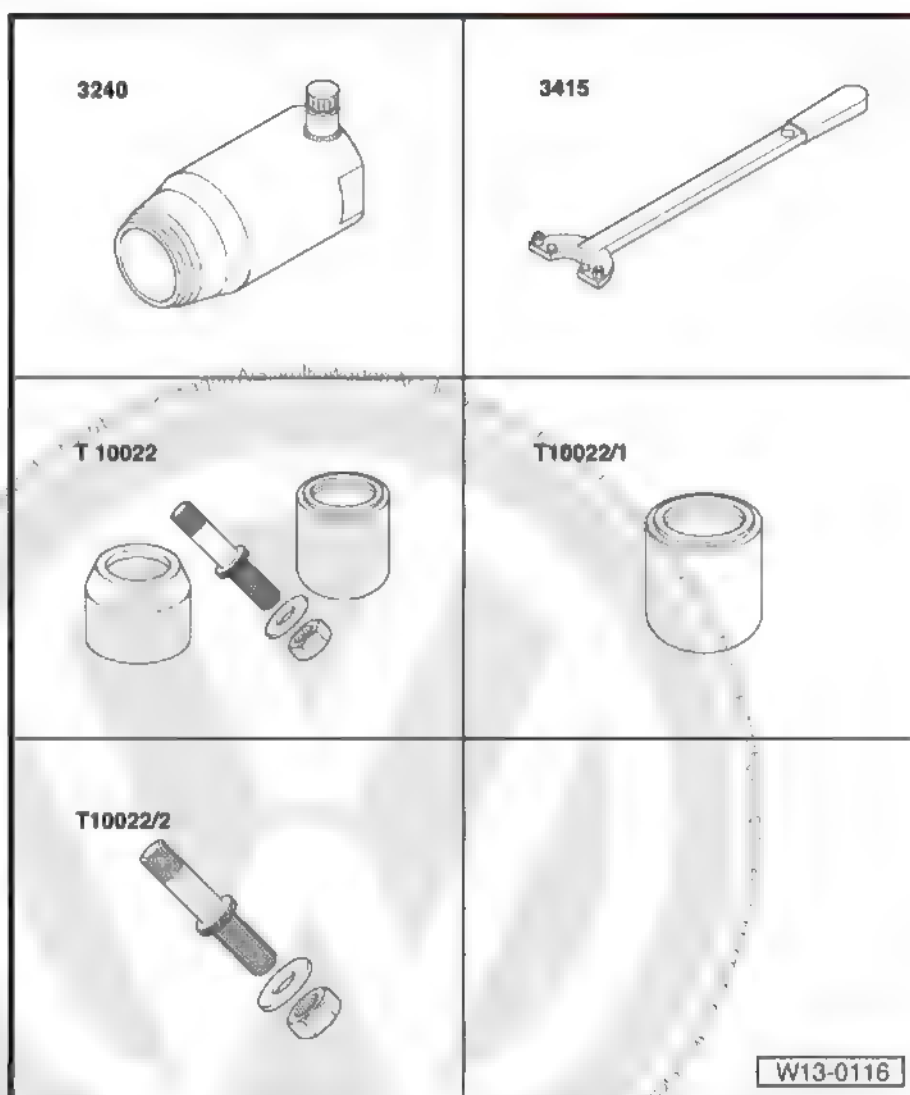
13 - Seal gasket

- ☐ Replace

14 - Crankshaft journal

- ☐ Lubricate with oil before **installing** oil pump.

2.1 Crankshaft sealant (pulley side) - replace



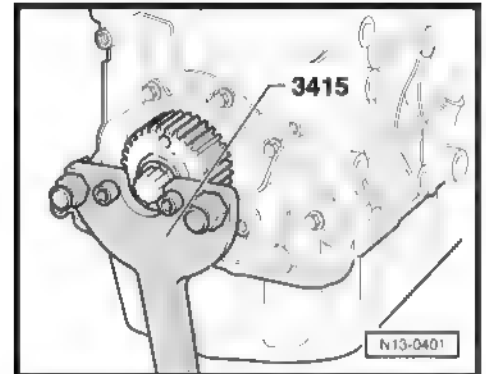


Special tools and workshop equipment required

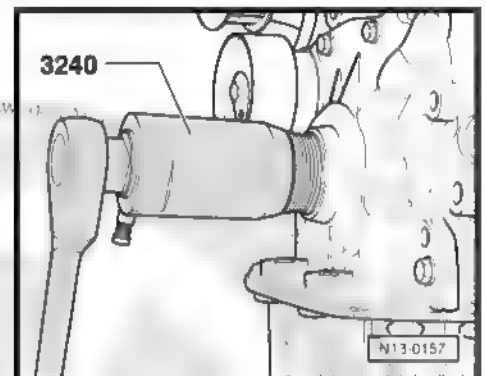
- ◆ Extractor -3240-
- ◆ Wrench -3415-
- ◆ Assembly sleeve -T10022-
- ◆ Sleeve -T10022/1-
- ◆ Spindle -T10022/2-

2.1.1 Removal

- First remove the tooth belt ⇒ [page 52](#) .
- Remove the crankshaft gear. To do so, lock the gear with Wrench -3415- .
- To guide the Extractor -3240- of the sealer, tighten the gear fastening bolt to the limit on the crankshaft.
- Rotate the inner part of the Extractor -3240- by two full turns (approx. 3 mm) of the inner part and lock by means of the knurled screw.

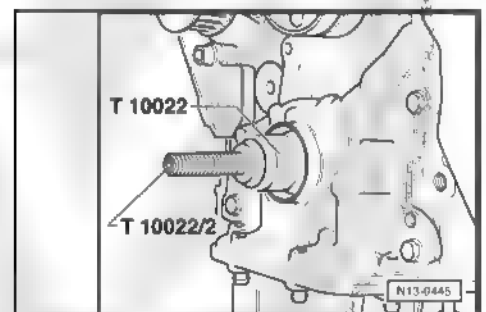


- Lubricate the threaded head of the Extractor -3240- , position it and bolt it down to the seal with as much force as possible.
- Loosen the knurled screw and turn the inner part against the crankshaft until the oil seal is pulled out.



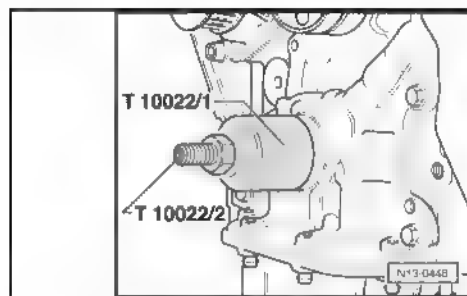
2.1.2 Installation

- Apply a light coat of oil to the seal lip.
- Position Assembly sleeve T 10022- on the crankshaft journal and tighten with the Spindle -T 10022/2- to the stop.
- Position the seal over the guide sleeve.



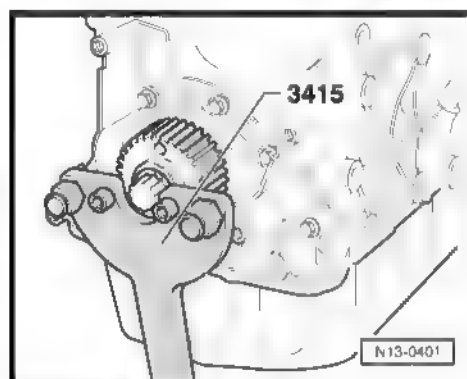


- Compress the sealant with Sleeve -T10022/1- to the stop.



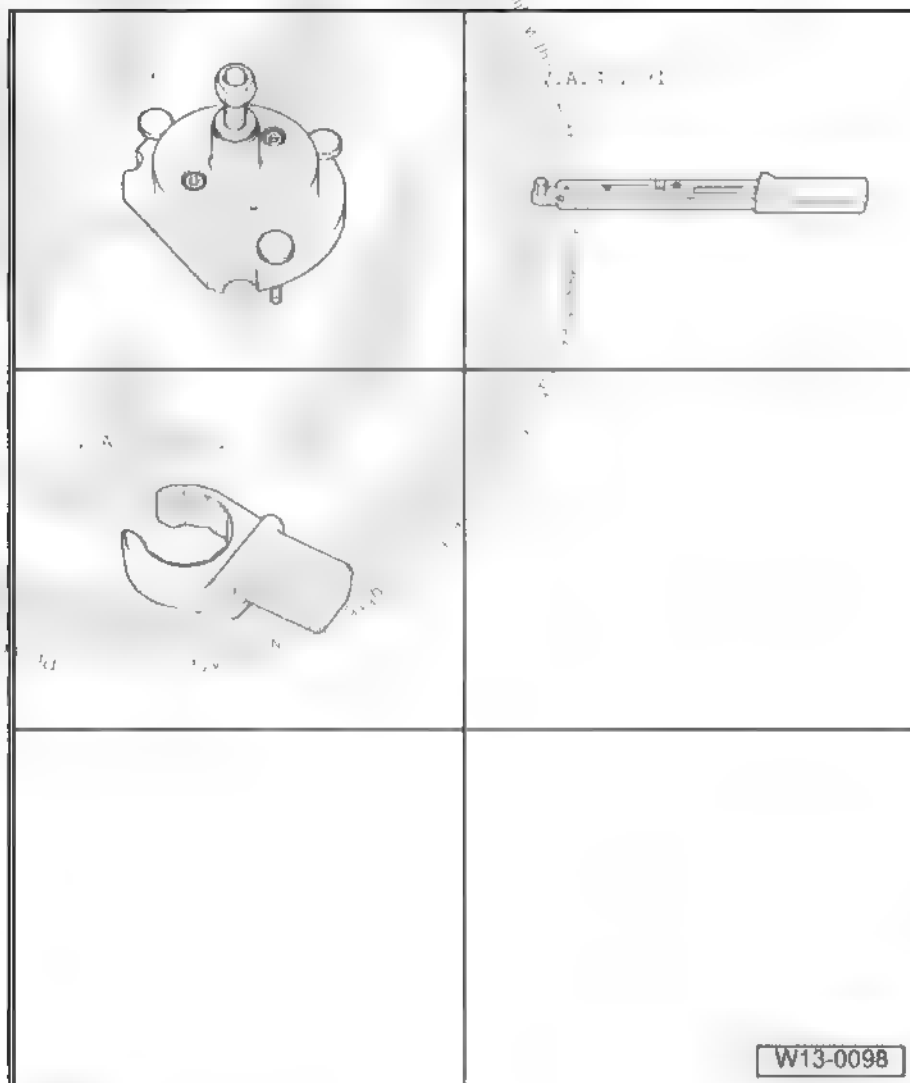
- Install the crankshaft gear and lock it with Wrench -3415- .
- Tighten the new screw to 90 Nm + 90° (angular torque may be applied in several stages).

How to install the toothed belt and set the camshaft timing
⇒ [page 52](#) .





2.2 Crankshaft flange (flywheel side) - replace



Special tools and workshop equipment required

- ◆ Fitting tool -T10017- or Fitting tool -T10017K- or Fitting tool -T10134-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Tool insert AF 24 -VAG 1332/11-
- ◆ Three hexagon head screws M6 x 35 mm
- ◆ Feeler gauge
- ◆ Ruler



Note

For the Freudenberg Flange, use Fitting tool -T10017-, for the SABO flange, use Fitting tool -T10017K- or Fitting tool -T10134-, for both tools, the method is the same. The reference for flange installation with rotor on the tool is: upper part SABO and lower part Freudenberg.



2.2.1 Crankshaft flange (flywheel side) with the rotor of the Engine speed sender - G28- - Remove

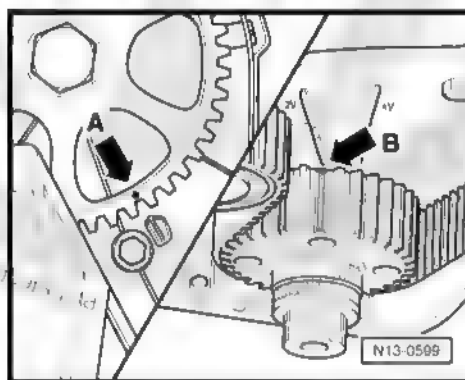


Note

- ♦ To better illustrate the sequence of operation it was performed with the engine removed.
- ♦ The work sequences with the engine removed and the transmission removed are identical.

Sequence of operations

- Remove engine flywheel.
- Remove the intermediate plate.
- Place the camshaft gear on the mark -arrow A-.
- Place the crankshaft at UNP in cylinder 1. The tooth marked on the camshaft gear must match mark "2V" on the flange/oil pump arrow -B-.
- Remove the oil sump ⇒ [page 81](#) .

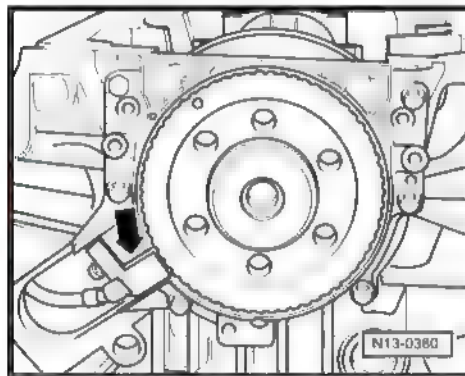


- Remove the Engine speed sender -G28- -arrow-.
- Loosen the stopper attaching screws.

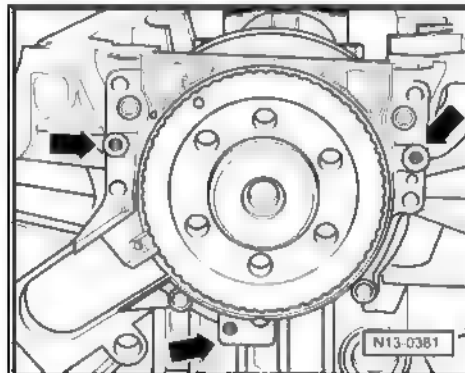


Note

The flange and the rotor are removed together from the crankshaft with three M6×35mm screws.



- Insert the three M6×35mm screws in the threaded flange/oil pump holes-arrows-.
- Tighten the screws alternately (max. 1/2 turn (180°) per bolt), on the flange and separate it from the crankshaft together with the rotor of the Engine speed sender -G28- .





2.2.2 Flange with rotor of Engine speed sender -G28- - Install



Note

- ◆ The flange with PTFE seal ring includes a seal lip support ring. This support ring fulfills the function of an assembly sleeve and shall not be removed before installation.
- ◆ Flange and rotor of Engine speed sender -G28- can no longer be separated or rotated after removal from the replacement part packing.
- ◆ The rotor of the Engine speed sender -G28- has its installation position for attachment to the fastening pin of the Fitting tool.
- ◆ The seal flange and the seal ring are one unit and can only be replaced along with the rotor of Engine speed sender -G28-.
- ◆ The Fitting tool has its assembly position, in relation to the crankshaft, determined by the guide pin which passes through a threaded hole in the crankshaft.

A - hexagon nut

B - threaded spindle

C - assembly housing

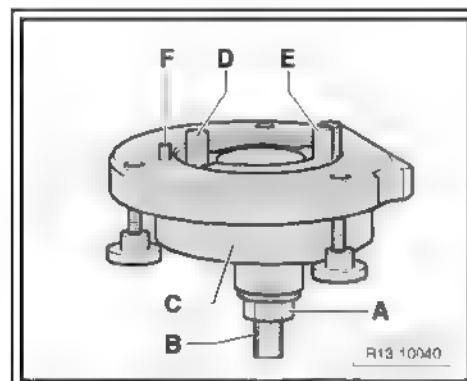
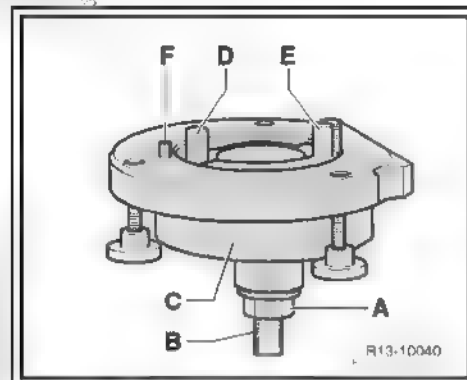
D - Allen screw

E - guide pin

F - dowel pin

A - Install the sealing flange with the rotor of the Engine speed sender -G28- on the Fitting tool

- Screw the hexagonal nut -A- until a little before flat tightening surface -B- of the threaded spindle.

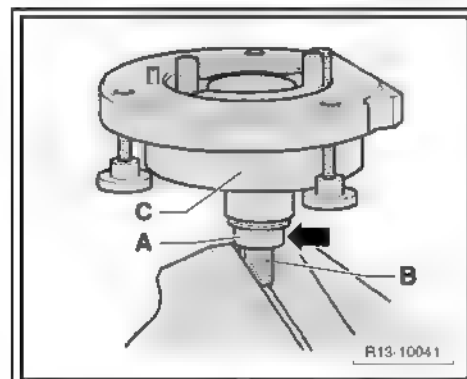


- Fasten the Fitting tool on the tightening surface -B- of the part threaded using a vice.
- Press assembly casing -C- downward, in order for it to be supported on hex nut -A- -arrow-.



Note

The inner part of Fitting tool and the assembly casing must be on the same plane.





- Remove safety clip -A- from the new flange.



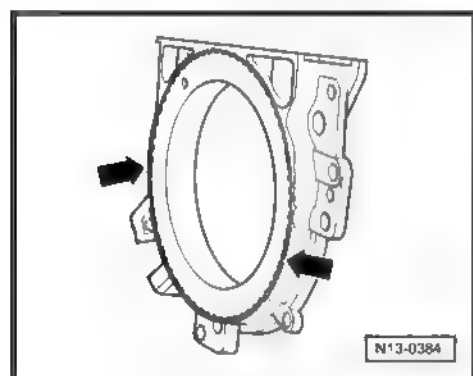
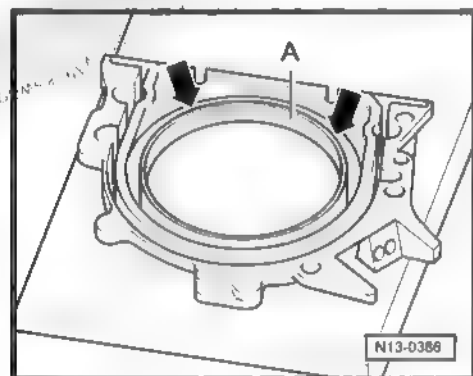
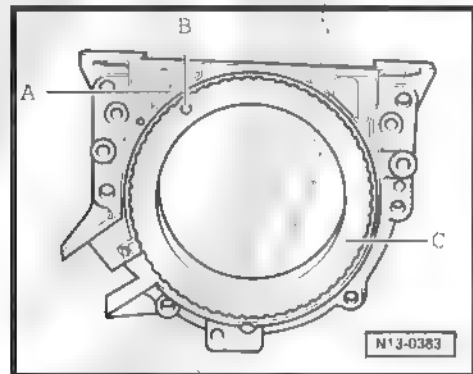
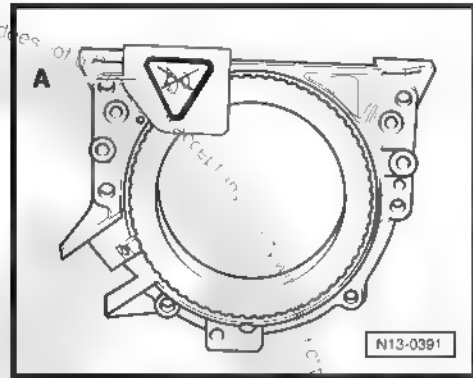
Note

The sensor rotor should not be removed from the flange or rotated.

Fixation hole -B- in the sensor gear -C- must be aligned with mark -A- on the flange.

- Place the flange front part on a clean, flat surface.
- Remove seal lip support ring -A- downward observing the -arrow- until it comes to rest on the level surface.

The upper edge of the rotor of the Engine speed sender -G28- and the front edge of the flange must be aligned -arrows-.



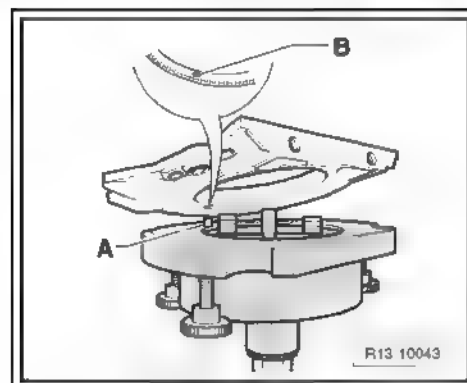


- Place flange with front side on Fitting tool in a way that the fastening pin -A- will enter hole -B- of the rotor of the Engine speed sender -G28-



Note

Ensure that the flange is on the same plane as the Fitting tool

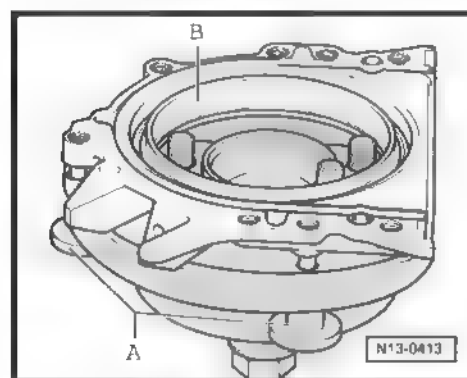


- Remove seal lip support ring -B- while tightening the three slotted screws -A- to the surface of the Fitting tool in a way that the fastening pin can no longer move from the hole in the rotor of the Engine speed sender -G28- .



Note

Make sure the rotor of the Engine speed sender -G28- rotor remains firmly in the Fitting tool during flange installation.



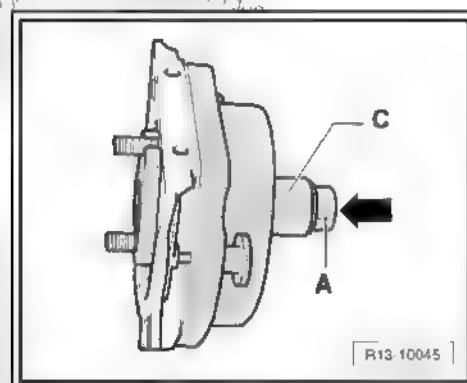
B - Install Fitting tool with the flange in the crankshaft

Prerequisites

- The crankshaft flange must be free of oil and lubricants.
- The engine is at the UNP of cylinder 1.

Sequence of operations

- Screw the hexagonal nut -A- to the end of the threaded part
- Press the threaded part of Fitting tool in the direction of -arrow- until the hexagonal nut -A- touches assembly casing -C-.
- Align the flattened side of the body for the sealing surface of the side of the oil sump of the block.

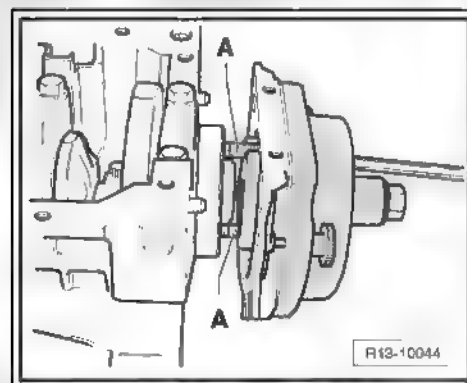


- Screw in Fitting tool with crosshead screws -A- on the crankshaft flange.



Note

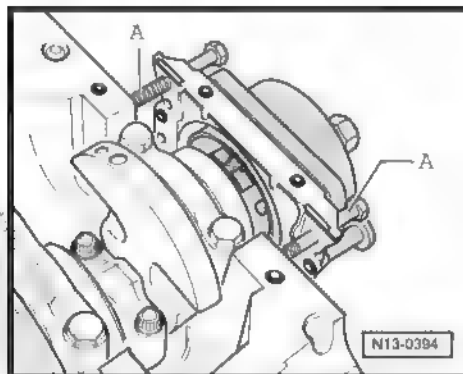
Introduce crosshead screws -A- by approx 5 thread turns in the crankshaft flange.





- Tighten two M 6 x 35 mm screws -A- to guide the flange on the engine's block.

C - Screw Fitting tool on the crankshaft flange

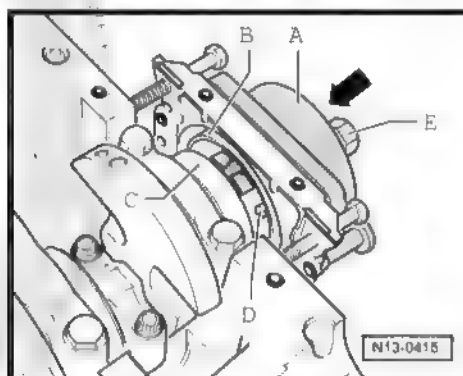


- Move assembly casing -A- by hand in the direction of the -arrow- until the seal lip support ring -B- touches on crankshaft flange -C-.



Note

The guide pin -D- of Fitting tool is introduced in a threaded hole in the crankshaft during assembly. This way, the rotor of the Engine speed sender -G28- is placed in its definite assembly position.



- Keep assembly housing in this position and manually tighten Allen screws of assembly device.
- Screw the hexagonal nut -E- by hand on the threaded part until it reaches the assembly casing -A-.

D - Install the rotor of the Engine speed sender -G28- with Fitting tool on the crankshaft flange

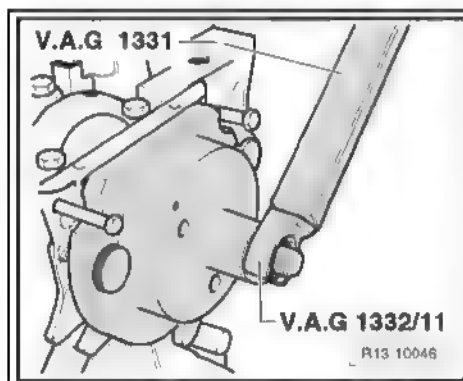
- Tighten the hex nut of Fitting tool with Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331- and Tool insert AF 24 -VAG 1332/11- . Tightening torque: 35 Nm.



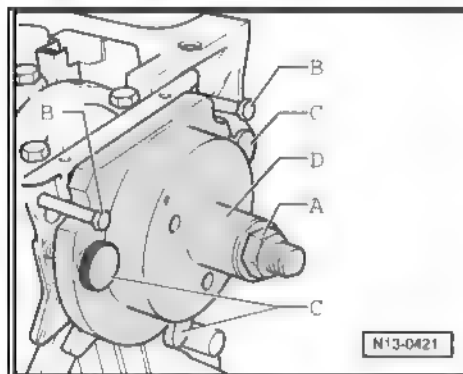
Note

After tightening the hexagon nut with 35 Nm there shall still be a small clearance between the engine block and the flange.

E ⇒ page 38 - Check installation position of the Engine speed sender -G28- on the crankshaft

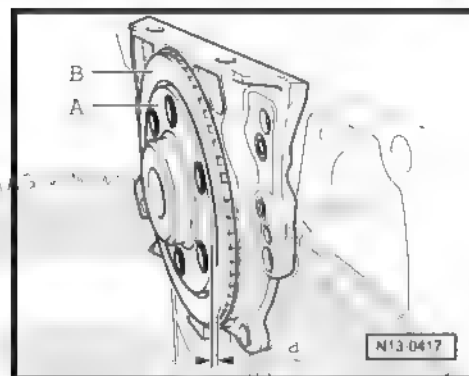


- Screw the hexagonal nut -A- to the end of the threaded part.
- Screw two M6x35mm screws -B- in the engine block.
- Loosen the three slotted screws -C- of the flange.
- Remove the fitting tool.
- Remove seal lip support ring

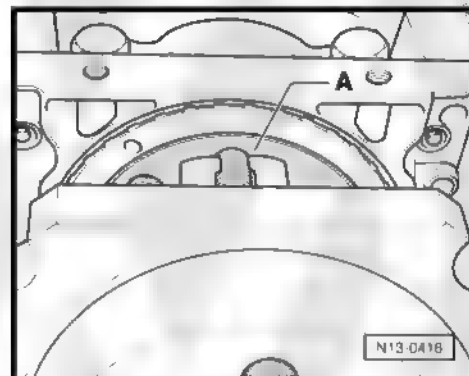




The rotor of the Engine speed sender -G28- is in the exact assembly position on the crankshaft when there is, between the flange -A- and the rotor of the Engine speed sender -G28- -B-, a gap -nd- of 0.5 mm.



- Put the gauge rod or a steel ruler against the crankshaft flange -A- (marked surface).



- Measure, using a blade gauge, -A- the distance -nd- between the gauge shaft and the rotor of the Engine speed sender -G28-.

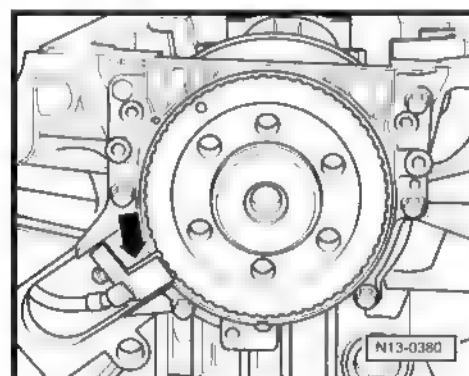
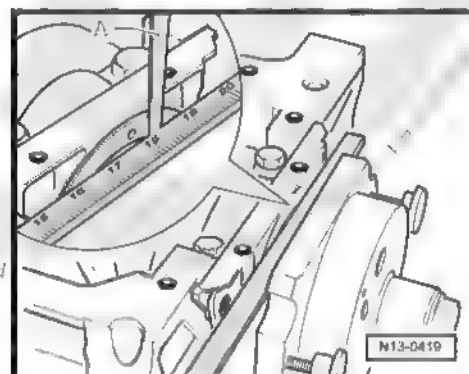
If measurement -nd- is too low:

- further compress the rotor of the Engine speed sender -G28-.

If measurement -nd- is reached:

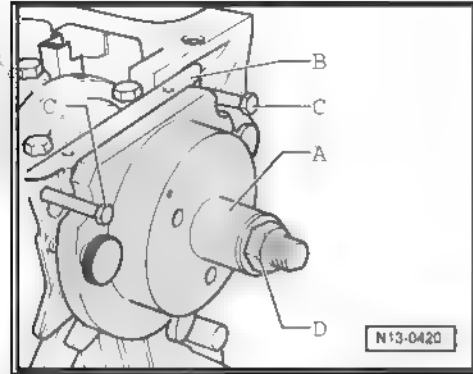
- Remove the fitting tool.
- Install the fixing screws of the sealing flange alternately crosswise. Tightening torque: 10 Nm.
- Install the Engine speed sender -G28- -arrow-. Tightening torque: 4.5 Nm.
- Install the oil sump ⇒ [page 81](#).
- Install the intermediate plate.
- Install the engine flywheel with new screws.

⇒ [page 37](#) F - Further compress the rotor of the Engine speed sender -G28-





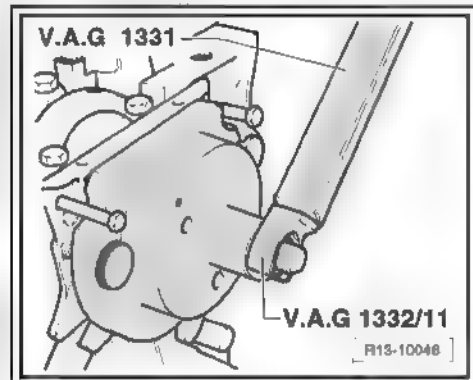
- Move assembly casing -A- with your hand towards flange -B-
- Tighten two M 6 x 35 mm screws -A- to guide flange -B- in the engine block
- Screw the hexagonal nut -D- by hand on the threaded part until it reaches the assembly casing -A-.



- Tighten the hex nut of Fitting tool with Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331- and Tool insert AF 24 -VAG 1332/11-. Tightening torque: 40 Nm.
- Check again the installation position of the Engine speed sender -G28- on the crankshaft

If measurement -nd- is too low:

- Tighten the hexagon nut of the assembly tool with 45 Nm once again.
- Check again the installation position of the Engine speed sender -G28- on the crankshaft.





3 Crankshaft - remove and install



Note

- ◆ In order to perform assembly work, attach the engine to the assembly support using Support for VW643 or VW 643/1 -VW 313- or Rotary stand for engine and transmission -VAS 6095-.
- ◆ Prior to the assembly work, it is necessary to lubricate the support and slide surfaces.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1 - Drag element

- ☐ To drive the oil pump.
- ☐ Lubricate with oil before installing oil pump.

2 - Bearing shells 1, 2, 3, 4 and 5

- ☐ Classification for spare parts order
⇒ [page 40](#).
- ☐ For bearing covers without lubrication grooves.
- ☐ For the engine block with lubrication grooves.
- ☐ Neither mix nor reuse used bearing shells (mark them).

3 - 65 Nm

- ☐ Renew each time after removing.

4 - Bearing cover

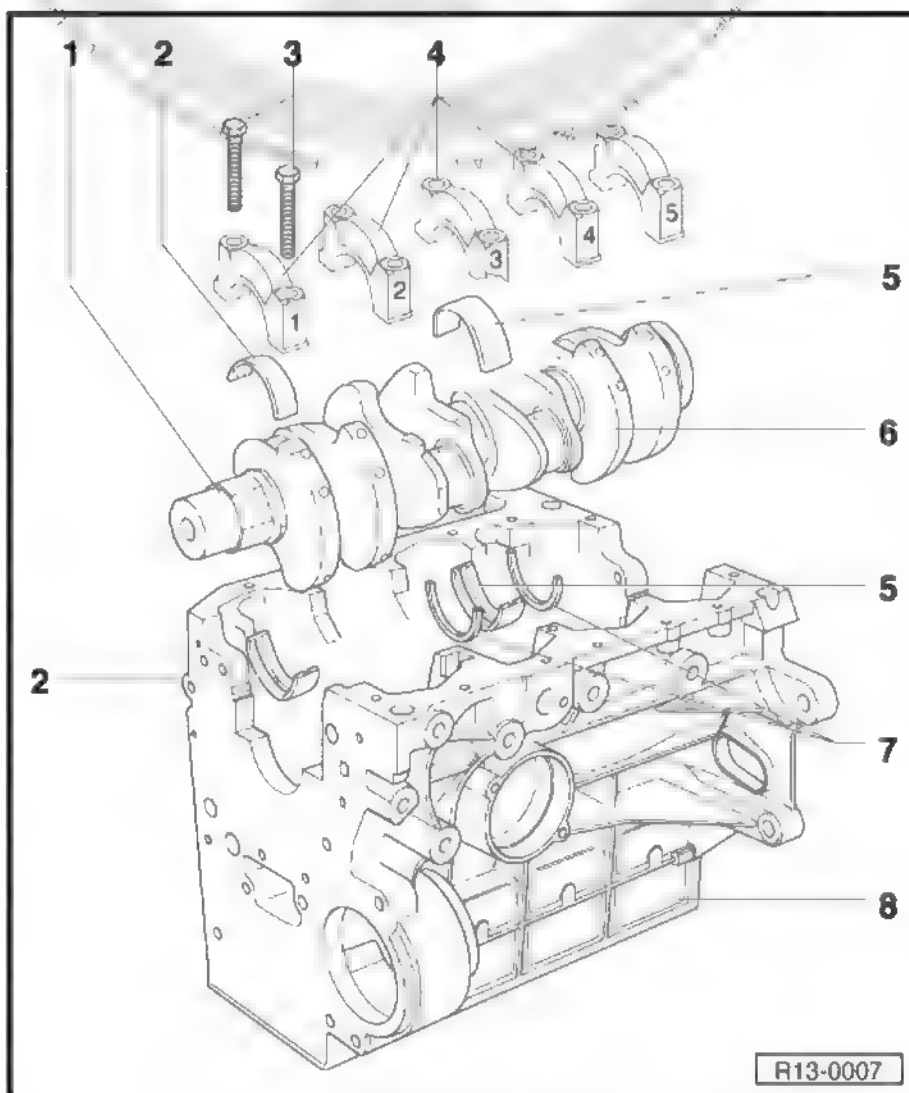
- ☐ Bearing cover 1: Pulley side.
- ☐ Bearing cover 3: With grooves for adjustment rings.
- ☐ Cylinder block bearing shell retainers/bearing shells must be on opposite sides of each other

5 - Bearing shell 3

- ☐ ⇒ [Item 2 \(page 39\)](#)
- ☐ Do not mix used bearing shells when reusing them (mark them).

6 - Crankshaft

- ☐ New axial clearance 0.070...0.243 mm wear limit: 0.25 mm.
- ☐ Measure the axial clearance with new Plastigage 0.016..0.036 mm wear limit: 0.070 mm



R13-0007



- ☐ Do not rotate the crankshaft while measuring radial clearance.
- ☐ Crankshaft dimensions → [page 41](#) .

7 - Adjustment ring

- ☐ To engine block, bearing 3.

8 - Engine block

- ☐ Check the diameter of the cylinders → [page 45](#)
- ☐ Piston and cylinder dimensions → [page 45](#) .

3.1 Identification of engine bearing shells

- The crankshaft bearing shells are classified at the factory and marked at the engine block and crankshaft as indicated. In order to identify the shells, the oil sump must be removed to be able to read the color code.

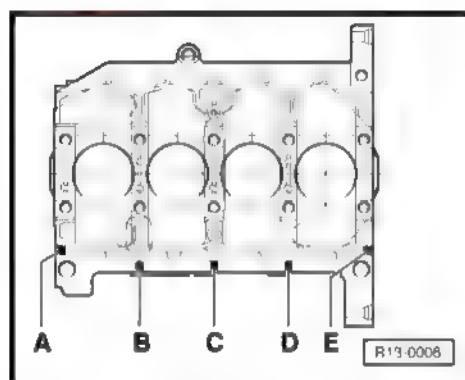
3.1.1 Code of upper bearing shell of the crankshaft



Note

- ◆ The engravings may also be grouped near letter D in the above illustration.
- ◆ In the absence of indications, use the yellow shell (color code G).

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5



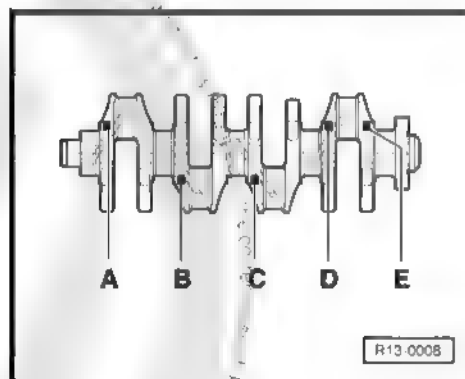
3.1.2 Code of the lower crankshaft bearing shell (bearing cover)



Note

May be engraved also on the mounting surface of the engine fly-wheel.

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5



3.2 Color codes

R	=	red
G	=	yellow
B	=	blue



3.3 Crankshaft dimensions

(dimensions in mm)

Grinding measures	Crank shaft bearings Stud-Ø	Rod bearing - Bearing journal-Ø
Basic measure	-0,022 54,00 -0,037	-0,022 47,80 -0,037
First grinding	-0,022 53,75 -0,037	-0,022 47,55 -0,037
Second grinding	-0,022 53,50 -0,037	-0,022 47,30 -0,037
Third grinding	-0,022 53,25 -0,037	-0,022 47,05 -0,037



4 Pistons and rods - remove and install



Note

Before performing assembly jobs it is necessary to lubricate support and sliding surfaces.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1 - Piston

- ☐ Check ➤ [page 44](#)
- ☐ Mark assembly position and correspondence to cylinder.
- ☐ The arrow at the head of the piston points to the pulley side.
- ☐ Assemble with piston ring tension belt.

2 - Piston pin

- ☐ In case of difficulties while removing, heat the piston to 60°C.
- ☐ Remove and install with Pin or VW 010-206 -10-206-.

3 - Piston pin retaining ring

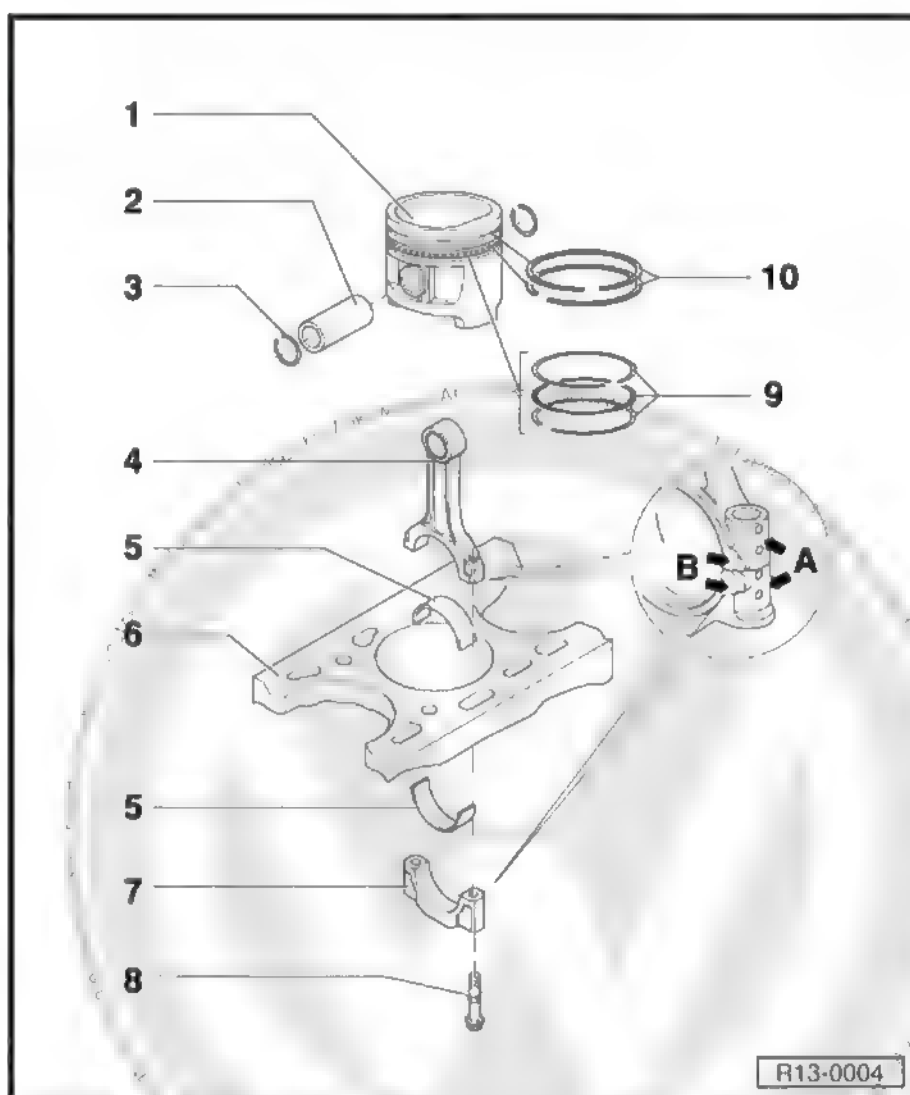
- ☐ Replace

4 - Rod

- ☐ Only replace complete set.
- ☐ Mark correspondence to cylinder -A-.
- ☐ Assembly position: markings -B- point to fly-wheel side.
- ☐ On unmarked rod bearings -B-, the rod bearing installation position will be the painted faces (rod bearing and cover), turned to the side of the oil sump ventilation device.
- ☐ The colors painted on the rod bearings and covers, in addition to defining the pair (rod bearing and cover) define the position (rod bearing in the cover).
- ☐ Axial clearance pistons/rod: 0.20 ... 0.40 mm wear limit: 0.50 mm.
- ☐ Is separated from the cover by rupture process ➤ [page 43](#)

5 - Bearing shell

- ☐ Observe assembly position.





- ☐ Do not mix up any used shells (they should be marked)
- ☐ Place centered bearing shells → [page 45](#)
- ☐ Check radial clearance with Plastigage: new: 0.020 - 0.061 mm wear limit: 0.091 mm Do not rotate the crankshaft while measuring radial clearance.

6 - Engine block

- ☐ Check the cylinder diameter → [page 45](#)
- ☐ Piston and cylinder dimensions → [page 45](#).

7 - Rod cap

- ☐ Observe assembly position.
- ☐ Thanks to the rupture process used for the rods, the cap can only be assembled in one position and only on the corresponding rod.
- ☐ Colors painted on rod caps and rods, in addition to defining the pair (rod and cap), define the position (cap on rod)
- ☐ Is separated from the rod by rupture process → [page 43](#)

8 - Rod screw

- ☐ 30 Nm + 90°
- ☐ Renew each time after removing.
- ☐ Lubricate washers and supporting surfaces.
- ☐ Tighten with 30 Nm to measure radial clearance without angular torque.

9 - Oil scraper ring

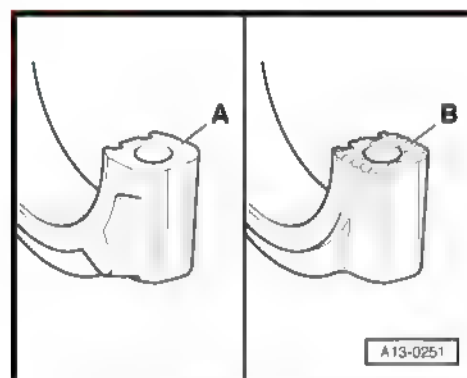
- ☐ Carefully remove and install the 3-part oil scraper rings by hand.
- ☐ Brand "TOP" must point to piston head.
- ☐ Check the opening between the gap openings → [page 44](#)
- ☐ Check the clearance of the ring in the piston slot → [page 44](#)

10 - Compression rings

- ☐ Remove and install compression rings with compression rings pliers.
- ☐ Brand "TOP" for piston bottom.
- ☐ Check the opening between the ring gap openings → [page 44](#)
- ☐ Check the clearance of the ring in the piston slot → [page 44](#)

Characteristic piston rods

- A- Conventional piston rods (even separation surfaces).
- B- Ruptured piston rods (irregular separation surfaces).

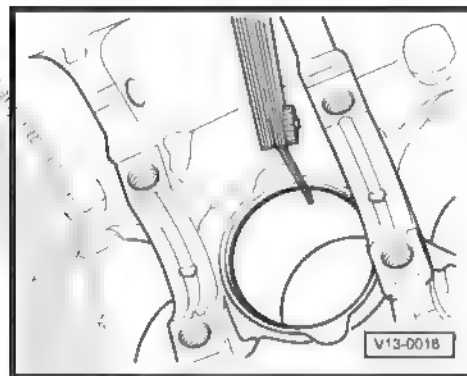




Gap openings of piston rings - check

- Insert the ring in right angle from upwards to the lower opening of the cylinder with an approx. distance of 15 mm to the cylinder edge.

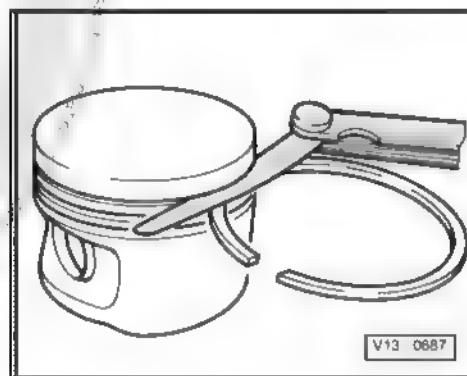
Ring	Gap openings	
	new	wear limit
1st Compression ring	0,20...0,35 mm	1,0
2nd Compression ring	0,20...0,40 mm	1,0
Oil scraper ring	0,25...0,75 mm	1,0



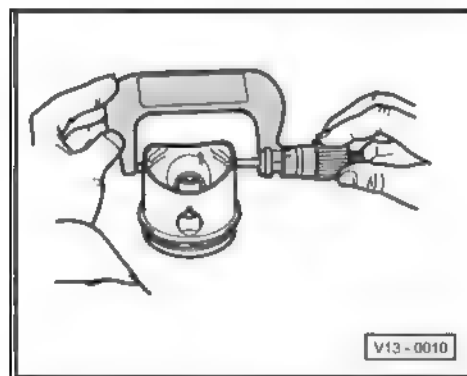
Check the ring clearance in the piston slot

Clean ring groove before testing.

Ring	Ring to groove clearance		
	new (with Mahle piston)	new (with Federal Mogul piston)	wear limit
1st Compression ring	0,030...0,080 mm	0,040...0,080 mm	0,15
2nd Compression ring	0,020...0,060 mm	0,020...0,060 mm	0,15
Oil scraper ring	0,010...0,150 mm	0,010...0,150 mm	0,20



Check the piston



Special tools and workshop equipment required

- ◆ External micrometer 60...90 mm



- Measure at approx. 10 mm from the lower edge displaced at 90° in relation to the piston pin axis. Nominal measure divergence max 0.07 mm. Nominal measure [→ page 45](#).

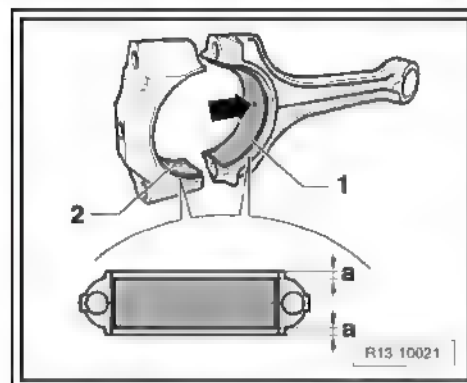
Rod bearing bushings: Installation

- 1- Bushing with holes to the piston pin lubrication channel -arrow-
- 1st and 2- Rod bearing bushings and rod bearing cover position -nd- right and left sides equal.
- -nd- Maximum tolerance = 0.2 mm.

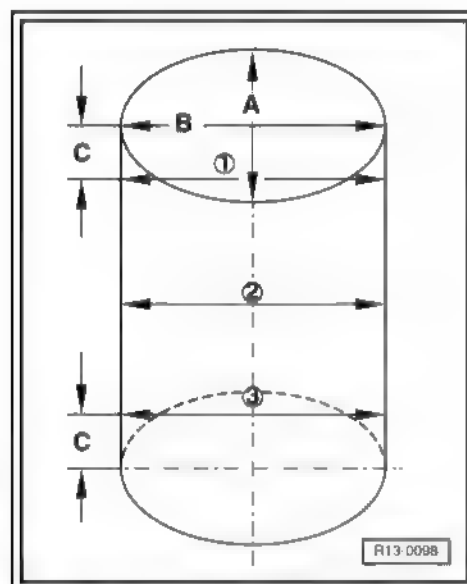


Note

The bushings for both the rod cap and the rod bushing have holes to avoid improper installation.



Check the diameter of the cylinders



Special tools and workshop equipment required

- ◆ Precision internal micrometer 50...100 mm
- Measure in three distinct transversally crossed points -A- and longitudinal direction -B- with a distance from the upper edge of more than 10.0 mm -C-. Tolerances in relation to the max. nominal measurement 0.08 mm. Nominal measure [→ page 45](#).



Note

The cylinder's diameter cannot be measured when the engine block is placed on the assembly support with Support -VW 540- or Rotary stand for engine and transmission -VAS 6095-, as in this case incorrect measurements may result.

4.1 Piston and cylinder dimensions

Engines BAH, BLH, BJA, and BPA

Grinding measures	Piston- $\varnothing^{(10)}$	Piston- $\varnothing^{(10)}$	Inside the cylinder- \varnothing
Manufacturer	Mahle	KS Pistons	



Grinding measures		Piston-Ø ¹⁰⁾	Piston-Ø ¹⁰⁾	Inside the cylinder-Ø
Basic measure	mm	76,465	76,475	76,51
Grinding machine I	mm	76,715	76,725	76,76
Grinding machine II	mm	76,965	76,975	77,01
Grinding machine III	mm	77,215	77,225	77,26

Engine CCRA and CFZA

Grinding measures		Piston-Ø ¹⁰⁾	Piston-Ø	Inside the cylinder-Ø
Manufacturer		Mahle	Federal Mogul	
Basic measure	mm	76,465	76,463...76,477	76,505...76,515
Grinding machine I	mm	76,715	76,713...76,727	76,755...76,765
Grinding machine II	mm	76,965	76,963...76,977	77,005...77,015
Grinding machine III	mm	77,215	77,213...77,227	77,255...77,265

10) The dimension data are for pistons without linings. Pistons that have linings on the measurement points may be up to 0.030 mm larger in Ø, depending on the mileage.



15 – Cylinder head, Valve gear

1 Cylinder head - disassemble and assemble

Check compression ➔ [page 62](#).



Note

- ◆ *When assembling a spare head, lubricate all contact surfaces between the support elements and the valve seats before assembling the head.*
- ◆ *The plastic packing pieces included to protect the open valves shall be removed just before installing the head.*
- ◆ *When replacing head, all cooling liquid must be replaced too.*
- ◆ *With the head removed, use Thrust plate -VW 5541/3- to fasten the head and valve support.*



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.





1 - 20 Nm + 90°

- ☐ Renew each time after removing.
- ☐ To tighten and to loosen, lock the camshaft gear with Retainer -3036-.

2 - Camshaft gear

- ☐ Observe fastening when assembling.
- ☐ Observe the installation position of the tooth belt [⇒ page 52](#).

3 - 10 Nm

- ☐ Apply the Adhesive -D 000 600 A2-.

4 - Rear cover of the mechanical distribution

5 - Cylinder head cover

- ☐ The sealing surfaces must not be ground.
- ☐ Cylinder head and cover are a pair, therefore, the pair engravings are located on the exhaust manifold side, next to the Hall sender -G40-.
- ☐ With integrated camshaft bearings.
- ☐ Remove all excess Engine sealant -AMV 188 001 02-.
- ☐ Apply the Engine sealant -AMV 188 001 02- before positioning it.
- ☐ For assembly, position vertically from above with the guides in the cylinder head holes.
- ☐ Removal and installation [⇒ page 72](#).

6 - Replace the engine head screw

- ☐ Renew each time after removing.
- ☐ Follow assemble instructions and sequence when loosening and tightening [⇒ page 57](#).

7 - Oil deflector

- ☐ Observe assembly position.
- ☐ Must be locked.

8 - Oil filler cap

- ☐ Replace the seal if damaged.

9 - Fittings

- ☐ Renew if damaged.

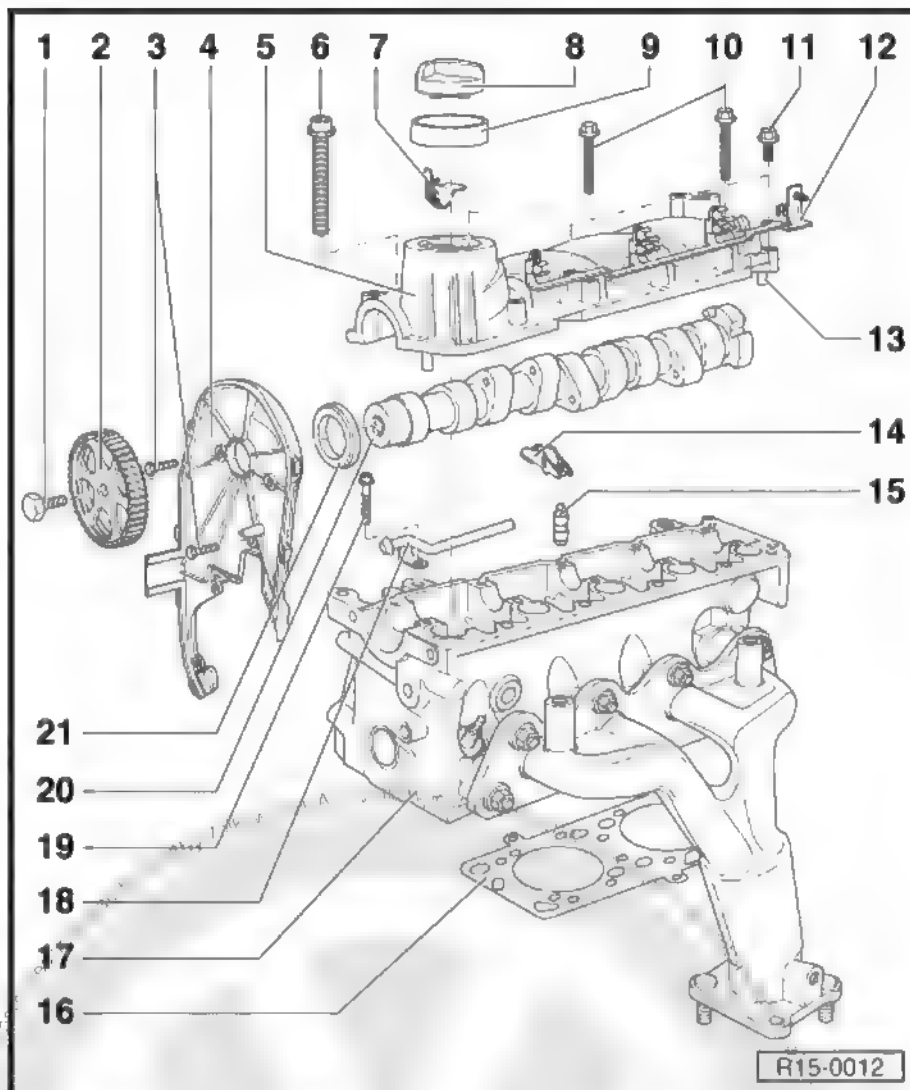
10 - 6 Nm + 90°

- ☐ Renew each time after removing.
- ☐ Follow installation instructions and sequence when loosening and tightening [⇒ page 72](#).

11 - 10 Nm

12 - Support

- ☐ For ignition cables.





13 - Guide-pin

14 - Rockers with rollers

- ☐ Examine the roller bearing.
- ☐ Lubricate the bearing surface with oil.
- ☐ For installation, fit safety fastener to the support element.

15 - Support element

- ☐ Do not mix up.
- ☐ With hydraulic offsetting of valve gap.
- ☐ Lubricate the bearing surface with oil.

16 - Head seal gasket

- ☐ Metal gasket.
- ☐ Replace.
- ☐ After replacement, renew coolant completely.

17 - Engine head

- ☐ Grinding the sealing surface on the side of the camshaft is not permitted.
- ☐ Cylinder head and cover are a pair, therefore, the pair engravings are located on the exhaust manifold side, next to the Hall sender -G40.
- ☐ Check for warping ⇒ [page 49](#)
- ☐ After replacement, renew coolant completely.
- ☐ Remove and install ⇒ [page 57](#) .

18 - Coolant tubing

- ☐ Cooling system hose connections diagram ⇒ [page 93](#) .

19 - 25 Nm

20 - Camshaft

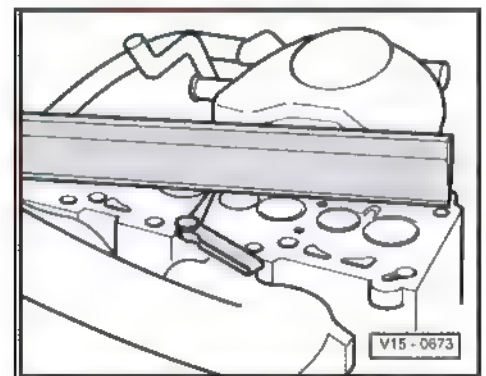
- ☐ Repair ⇒ [page 65](#) .
- ☐ Removal and installation ⇒ [page 72](#) .

21 - Camshaft seal

- ☐ Apply oil lightly on sealing ring lips.
- ☐ Replace ⇒ [page 70](#) .

Cylinder head - check for warping

Max. permissible warp: 0.05 mm

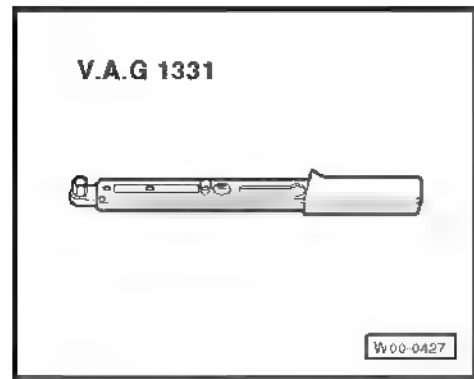


1.1 Semi-automatic tensioner pulley of the toothed belt - check

Special tools and workshop equipment required

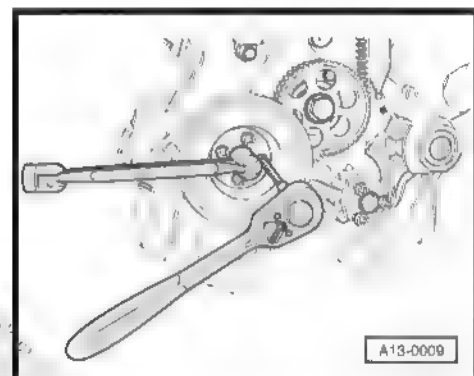


- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-



Test sequence

- Remove air filter housing ⇒ [page 144](#) .
- Remove lower engine compartment anti-noise.
- Remove right front wheel housing cover: ⇒ Body - external mountings; Rep. Gr. 66 ; External equipment .
- Mark the rotation direction of the Poly-V belt and remove it ⇒ [page 21](#) .
- Remove the heat deflector from the exhaust manifold.
- Remove the Poly-V belt tensioner pulley.
- Remove the crankshaft pulley.
- Remove the upper and lower mechanical distribution cover.
- Turn crankshaft twice in the direction of the movement of the engine until it is at the UNP of cylinder 1.





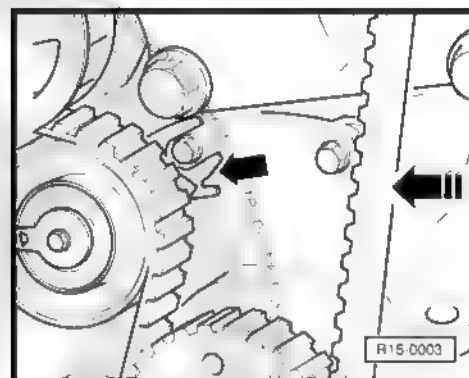
- Memorize the position of the belt tensioner indicator arm -arrow-. Now press strongly with thumb-arrow- on the toothed belt. The indicator arm will be displaced.
- Loosen the toothed belt
- Turn crankshaft two turns in the direction of engine rotation.
- Check the position of the indication arm. It must return to its original position

If the needle does not return to the original position:

- Replace belt tensor.

If the belt tensioner is OK:

- Install the upper and lower mechanical distribution cover.
- Install the crankshaft pulley (observe the fixing). Tightening torque: 20 Nm.
- Install the Poly-V belt tensioner pulley. Tightening torque: M 8: Tighten to 20 Nm + 90°, M 10: 45 Nm.
- Install the heat deflector of exhaust manifold. Tightening torque: 10 Nm.
- Install Poly V belt ⇒ [page 21](#).



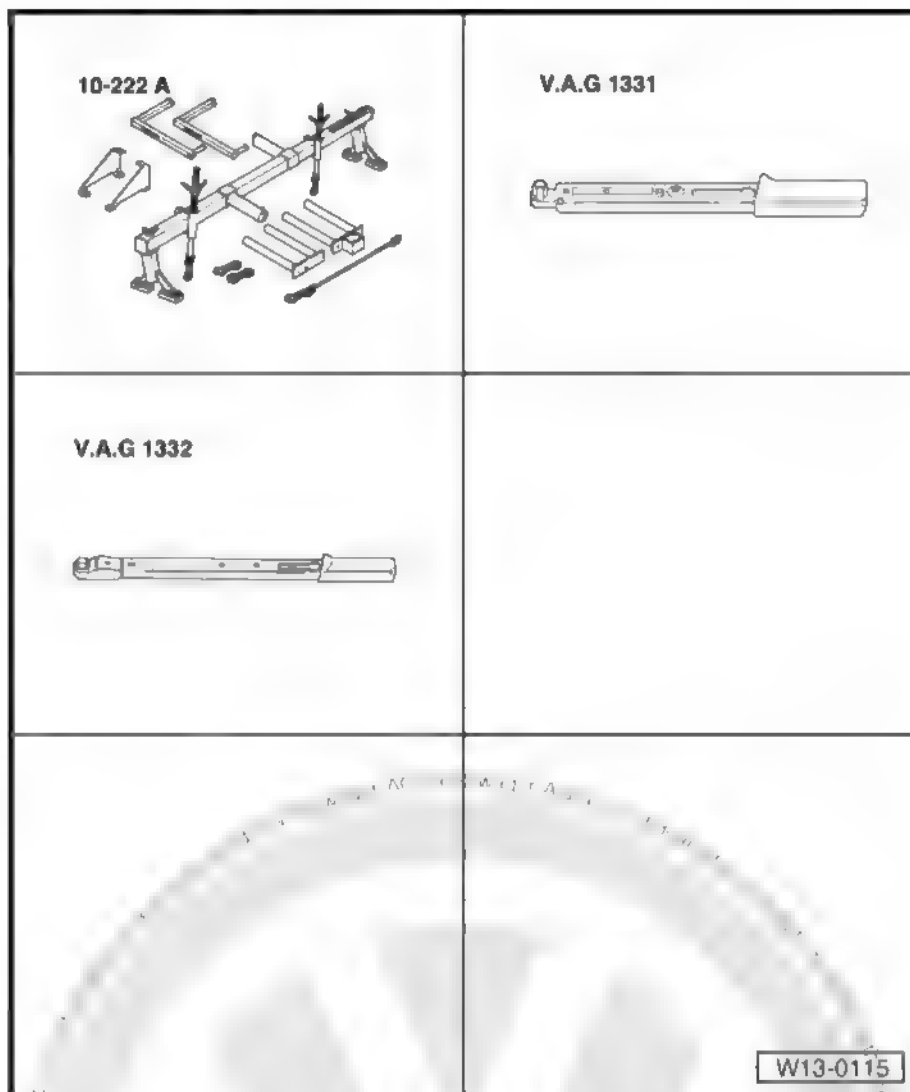
Note

During Poly V belt installation, carefully observe proper belt seating on pulley.

- Install the right front wheelhouse protection: ⇒ Body - external mountings; Rep. Gr. 66 ; External equipment .
- Install lower engine compartment noise insulator.
- Install air filter housing ⇒ [page 144](#) .



1.2 Tooth belt - remove, install, and adjust



(Adjust the command time)

Special tools and workshop equipment required

- ◆ Support -10--222 A- with Installation device - 10-222 A/1- or the Adapter -T02007-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-

No illustration:

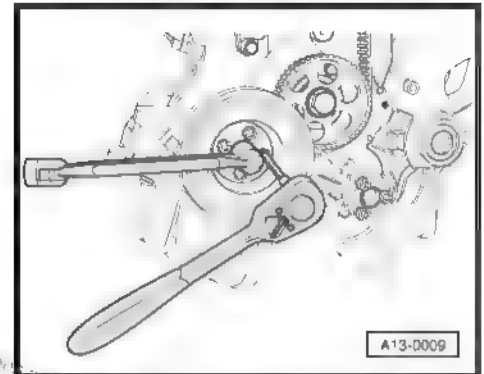
- ◆ Hoisting eyelets No. of the replacement part: Support -030 103 390 F- pulley side and Support -030 103 390 G- engine steering side
- ◆ -Hexagonal key-

1.2.1 Removal

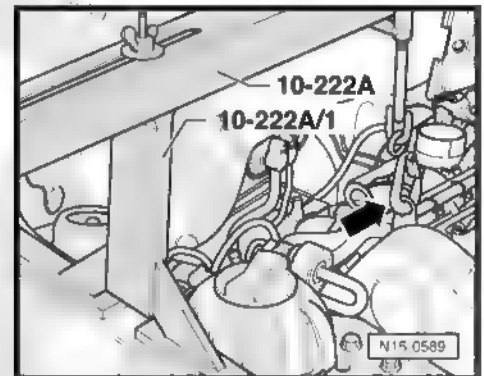
- Remove air filter housing ➔ [page 144](#) .
- Remove right front wheel housing cover: ➔ Body - external mountings; Rep. Gr. 66 , External equipment .



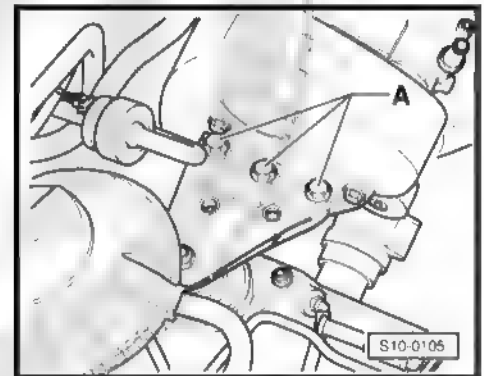
- Mark the Poly-V belt operation direction and remove it
→ [page 21](#) .
- Remove the heat deflector from the exhaust manifold
- Remove the Poly-V belt tensioner pulley.
- Remove the mechanical distribution upper cover
- Remove the crankshaft pulley.
- Remove the mechanical distribution lower cover.
- Loosen cooling system tubes from the engine head.
- Screw lifting eyelets into threads for cooling system hose in cylinder head. Tightening torque: 25 Nm.



- Place the Support -VW 061 (VWB) - or - 10-222A- or the Adapter -T02007- as shown in illustration and support the engine in the assembly position.
- Remove the coolant container (hoses remain connected).
- Fix the engine a little and loosen fixation screws -A-.

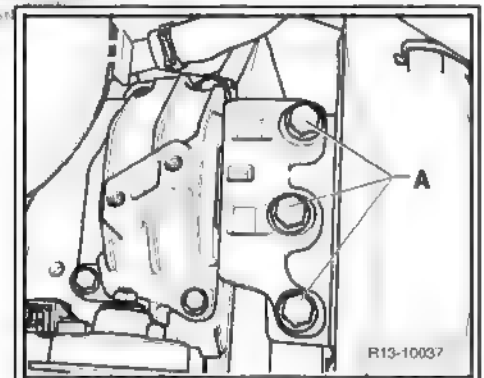


Vehicles produced until December 9, 2008



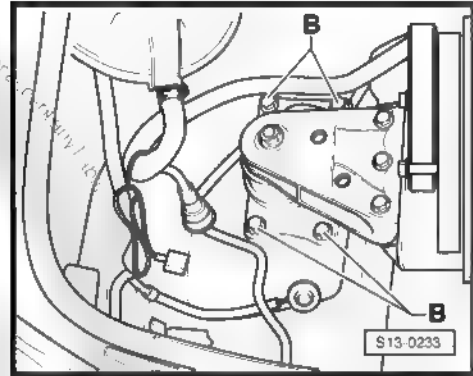
Vehicles produced as from December 10, 2008

- Loosen the fastening screws -B- and also the complete aggregate support.



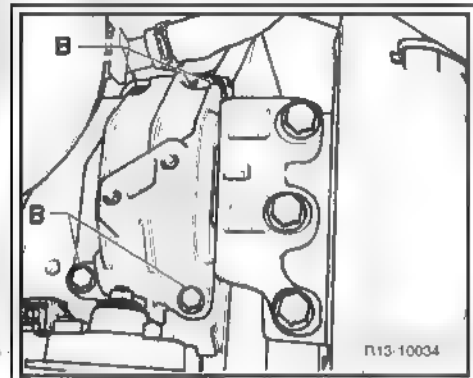


Vehicles produced until December 9, 2008



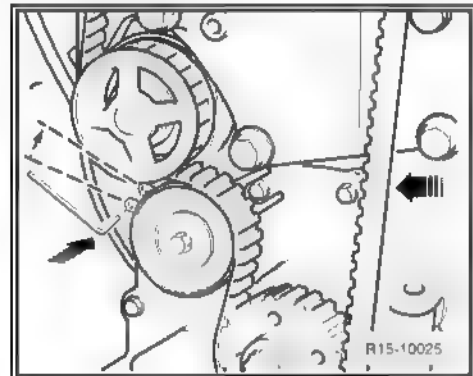
Vehicles produced as from December 10, 2008

- Remove the engine support on the cylinder block.
- Mark toothed belt operation direction.
- Release the belt tensioner and remove the toothed belt.



1.2.2 Tensioner without adjustment

- Compress the tooth belt towards the -arrow-, right side.
- With the bearings aligned, install the lock pin (2.5 mm Allen).
- Remove the tensioner.
- Remove the tooth belt and mark the direction it turns in.



1.2.3 Installation

Prerequisites

- The engine shall be lukewarm, at maximum.
- The pistons shall not meet at PMS.



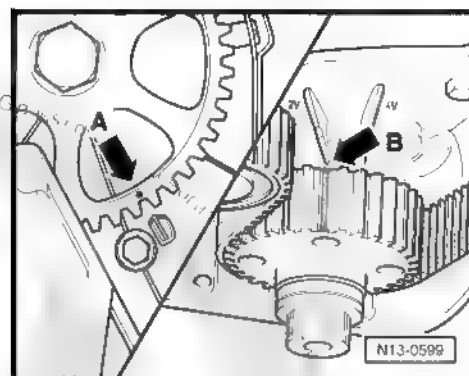
Note

Turning camshaft the valves may hit the pistons that are in the UNP.

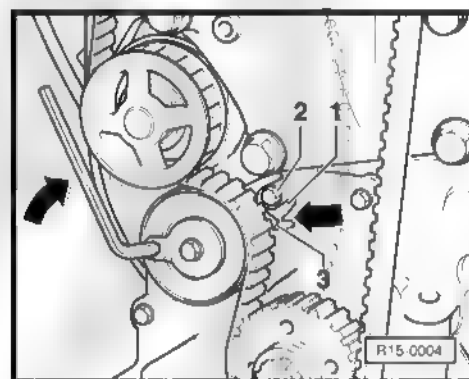


Sequence of operations

- Place the camshaft gear on the mark -arrow A-
- Adjust crankshaft at UNP of cylinder. 1. Crankshaft gear chamfered tooth must align with mark -2V- flange of pump -arrow B-
- Install the toothed belt. Check the turning direction of used toothed belts.

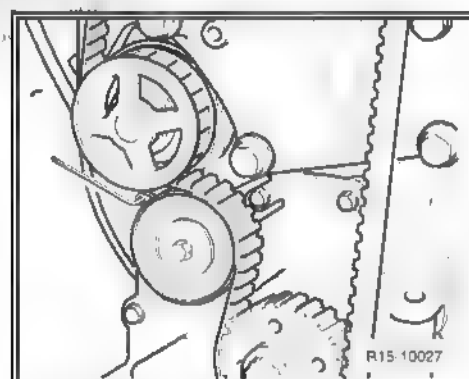


- Tighten the fastening screw of the belt tensioner by hand. The notch of the base plate -1- must reach above the fixing screw -2-.
- Tension the toothed belt by turning the belt tensioner in the direction of the -arrow- until the pointer -3- is over the base plate mark -arrow-.
- Tighten the fastening screw of the belt tensioner by hand. Tightening torque: 20 Nm.
- Turn crankshaft twice in the direction of the movement of the engine until it reaches the UNP of cylinder 1.
- Next, the adjustment of the toothed belt and the position of the belt tensor must be checked again.

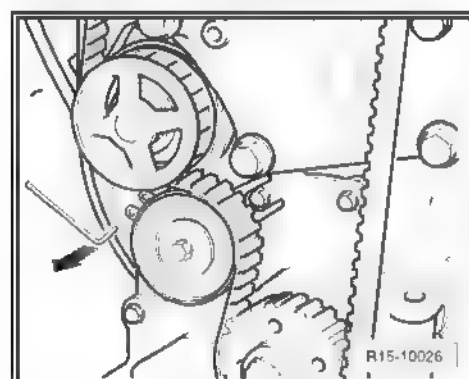


1.2.4 Tensioner without adjustment

- Install the tooth belt on the camshaft and water pump gear.
- Install the tensioner with the lock pin (2.5 mm Allen) installed.
- Apply 20 Nm torque to securing screw.
- Install the belt on the crankshaft gear.

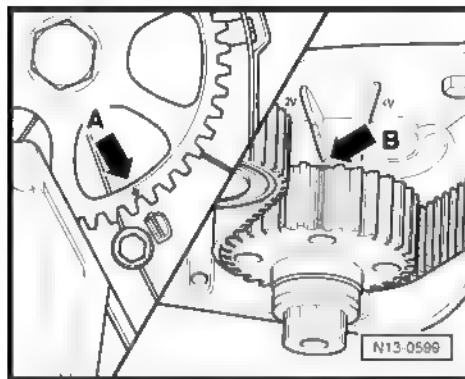


- Remove the lock pin (2.5 mm Allen) from the tensioner.
- Turn crankshaft two turns in the engine rotation direction until reaching cylinder 1 upper neutral position.
- Then check gear position again.





- If necessary, repeat the tooth belt adjustment procedure.
- Install the engine right bracket on the engine block. Tightening torque: 50 Nm.
- Install the mechanical distribution lower cover.
- Install the crankshaft pulley (observe the fixing). Tightening torque: 20 Nm.
- Install the Poly-V belt tensioner pulley. Tightening torque: M 8: Tighten to 20 Nm + 90°, M 10: 45 Nm.
- Install heat deflector of exhaust manifold. Tightening torque: 10 Nm.
- Install the engine aggregate support. Tightening torque ➔ [page 13](#).
- Install the mechanical distribution upper cover.
- Install Poly V belt ➔ [page 21](#).



Note

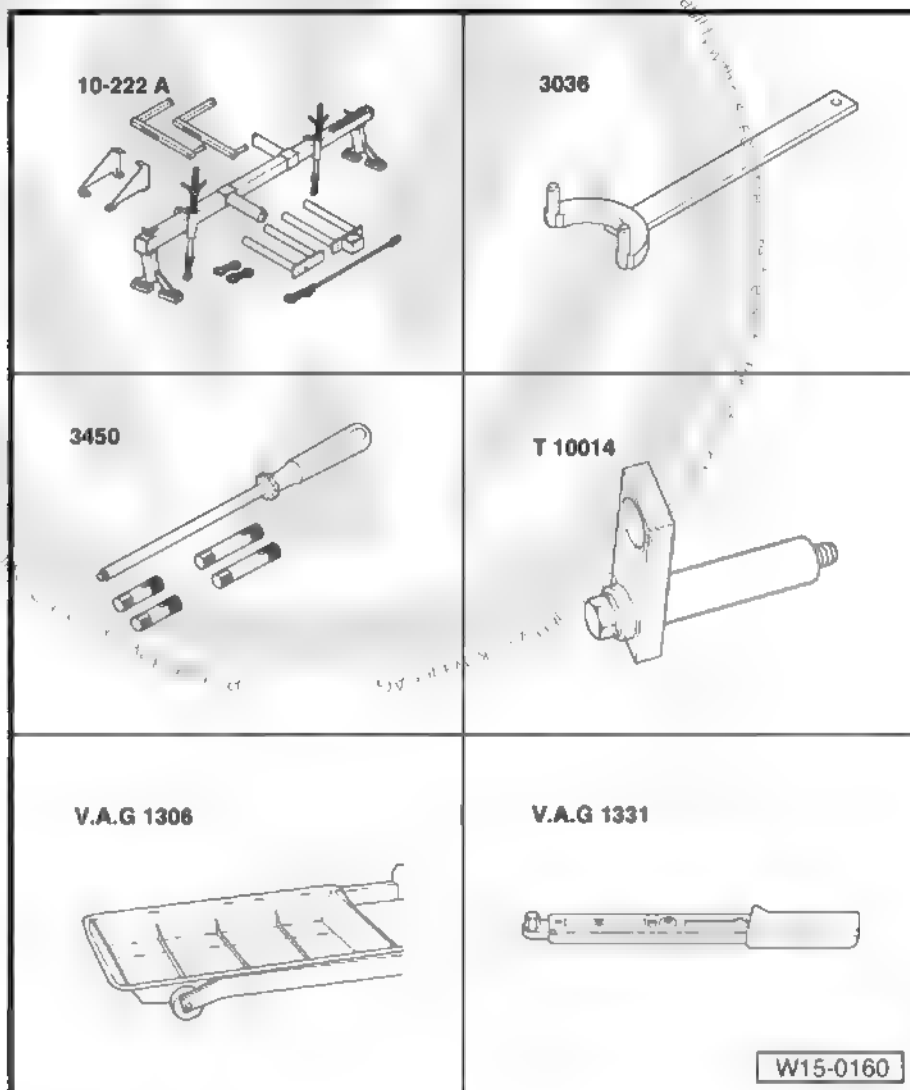
During Poly V belt installation watch closely the proper seating of belt on the pulley.

- Install the right front wheelhouse protection: ➔ Body - external mountings; Rep. Gr. 66 ; External equipment .
- Install lower engine compartment noise insulator.
- Install the coolant container.
- Remove suspension hole of engine head.
- Install cooling fluid tubes on engine head. Tightening torque: 25 Nm.
- Install air filter housing ➔ [page 144](#).





1.3 Cylinder head - remove and install



Special tools and workshop equipment required

- ◆ Support -VW 061 (VWB) - or - 10-222A- with Installation device - 10-222 A/1- or the Adapter -T02007-
- ◆ Retainer -3036-
- ◆ Guides -3450-
- ◆ Support -T10014- or Latch -T10109-
- ◆ Multi-toothed ring spanner -M11/M12 (enc. 1/2") -VW 001N- or Special long spanner -T10070-
- ◆ Oil sump -VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-

No illustration



V.A.G 1332



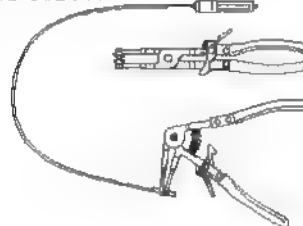
W00-0428

- ◆ Hoisting eyelets No. of the replacement part: Support -030 103 390 F- (on the belt pulley side), and Support -030 103 390 G- engine flywheel side
- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-
- ◆ Standard-type clamp pliers -VW 5162 (VWB) - or - VAS 5024A-

Initial conditions

- Engine in lukewarm temperature, at maximum.

VAS 5024 A



W00-1179

1.3.1 Removal



Note

To perform this work, it is necessary to separate the earth cable from the Battery -A-. Thus, check whether the vehicle has a coded radio. If this is the case, request the anti-theft code.

- Disconnect the battery earth strap Battery -A- with the ignition switched off.
- Remove air filter housing ⇒ [page 144](#) .
- Loosen cooling system tubes from the engine head.
- Screw lifting eyelets into threads for cooling system hose in cylinder head. Tightening torque: 25 Nm.
- Loosen right front wheel housing protector ⇒ Body - external mountings; Rep. Gr. 66 ; External equipment .
- Remove toothed belt ⇒ [page 52](#) .
- Remove camshaft sprocket. To loosen the fixing screw, lock the gear by means of the Blocker -3036- .

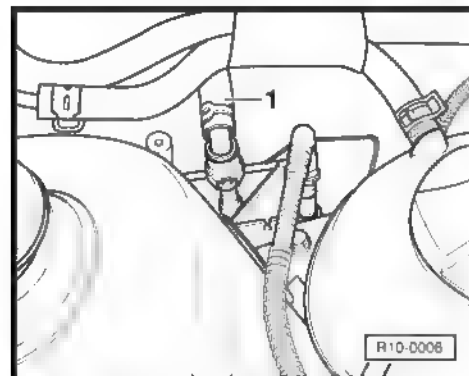


WARNING

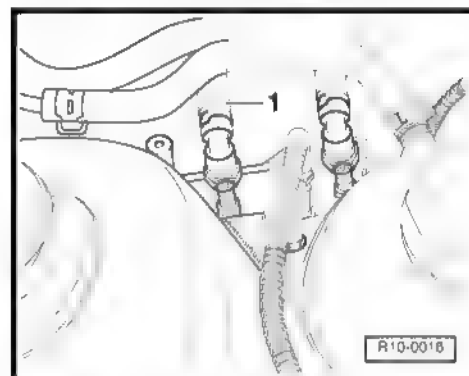
The fuel supply hose is under pressure. Prior to loosening the hose junctions, place a cloth around them. Then eliminate the pressure by carefully removing the hose.



- Disconnect fuel supply tubing -1- (press the release button).
(Engines BAH, BLH, and CFZA).

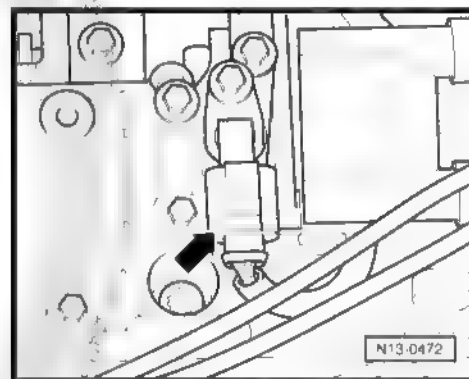


- Disconnect fuel supply tubing -1- (press the release button).
(Engines BJA, BPA, and CCRA).
- Release The activated charcoal reservoir solenoid valve 1 - N80- -1- on the intake manifold.



- Close tubes so that no dirt enters the fuel supply system.
- Release or disconnect the following components:
 - ◆ Intake manifold vacuum hose to the power brake.
 - ◆ Insertion connector Ignition transformer -N152- and of Throttle valve module -J338- .
 - ◆ Injection valve connectors.
 - ◆ Connector to Engine speed sender -G28- and Intake manifold pressure sender -G71- / Intake air temperature sender -G42- .
 - ◆ Double insertion connector of Knock sensor 1 -G61- (intake manifold side).
 - ◆ Connector to Coolant temperature sender -G62- and Oil pressure switch -F1- .

- Disconnect the 3-pole connector from flange Hall sender - G40- -arrow-.
- Completely remove the fuel distributor with all injectors
⇒ [page 142](#) .
- Open and close the coolant container lid again in order to release pressure from the cooling system.
- Drain the cooling system ⇒ [page 96](#) .
- Remove the water pump along with the rear cover of the mechanical distribution ⇒ [page 102](#) .
- Remove fastener in the body of thermostatic valve of cooling system, that holds cooling system of pipe in the pump.
- Remove the thermostatic valve housing of the engine head.
- Disconnect all connection pipes, of the cooling system, of vacuum and aspiration of the engine head.
- Loosen the exhaust manifold exhaust pipe.
- Release the oil dipstick guide-tube of the intake manifold.





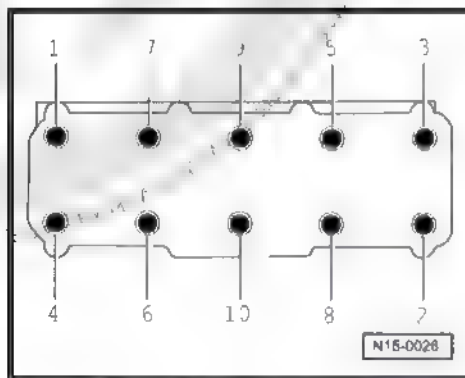
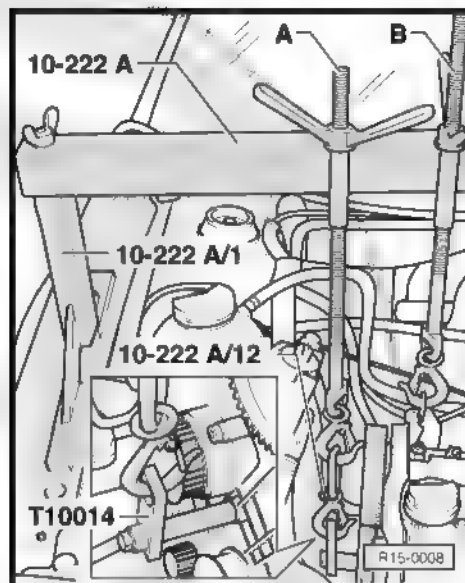
- Then lift the engine slightly with the help of device -B-.



Note

Since the suspension hole is screwed to the engine head, an additional support should be secured to the engine block for engine support.

- Screw, as indicated, the Support -T10014- or Latch -T10109- into the threaded hole in the water pump area of the engine block. Tightening torque: 20 Nm.
- Lift the engine slightly with the help of device -A- until the threaded part -B- is relieved.
- Remove the threaded part -B-.
- Loosen screws from engine head in the indicated sequence and remove them.
- Carefully raise engine head.



1.3.2 Installation



Note

- ◆ *Remove new seal gasket from engine head from packaging only immediately before its installing.*
- ◆ *Handle the new gasket with great care. Damage will cause leakages.*
- Place a clean cloth on the cylinder to avoid dirt or sandpaper debris entering the cylinder walls and pistons.
- Avoid that dirt or file debris enters the cooling system too.
- Carefully clean all cylinder head and engine block sealing surfaces. During this operation, carefully assure that no scratches or longitudinal grooves occur (abrasive material used must never be of a grade lower than 100).
- Carefully remove any abrasive residues with a clean cloth.
- Place piston of cylinder 1 at the UNP and turn crank shaft backwards a little

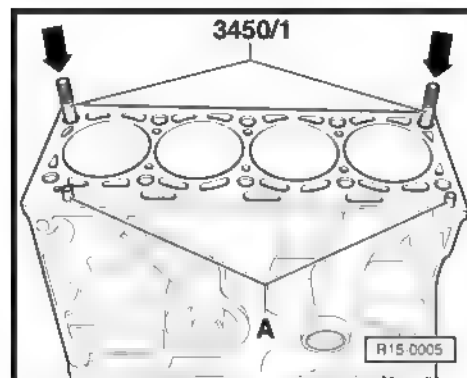


- To center the engine head, screw in Guides -3450/1- into the outer back holes of the screws of the motor head -arrows-.
- Place the new head gasket on centering pins -A-. The inscription (spare part number) must be legible.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

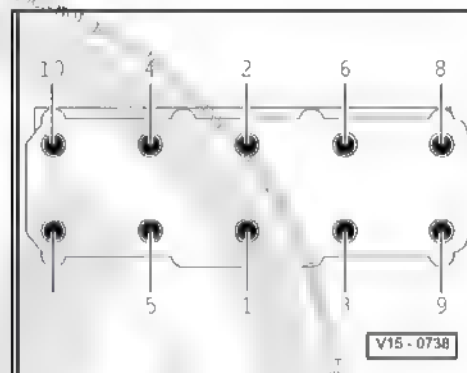


- Position the cylinder head, insert 8 new bolts and hand-tighten them.
- Loosen the claws from the Guides -3450- with a pair of Extractor -3450/3- through the screw holes. To do so, turn Extractor -3450/3- to the left until the guides are removed.
- Now insert the two remaining head screws and tighten them by hand.
- Tighten engine head screws in the tightening sequence indicated by the illustration:
- Tighten all new screws to 30 Nm.
- Then tighten all screws by another 180° with a solid wrench.



Note

Retightening of the engine head screws is not necessary after repairs.



- Continue installation in removal reversed order.



Note

When turning the camshaft, the crankshaft shall not be at TDC. Risk of damage of valves/piston heads.

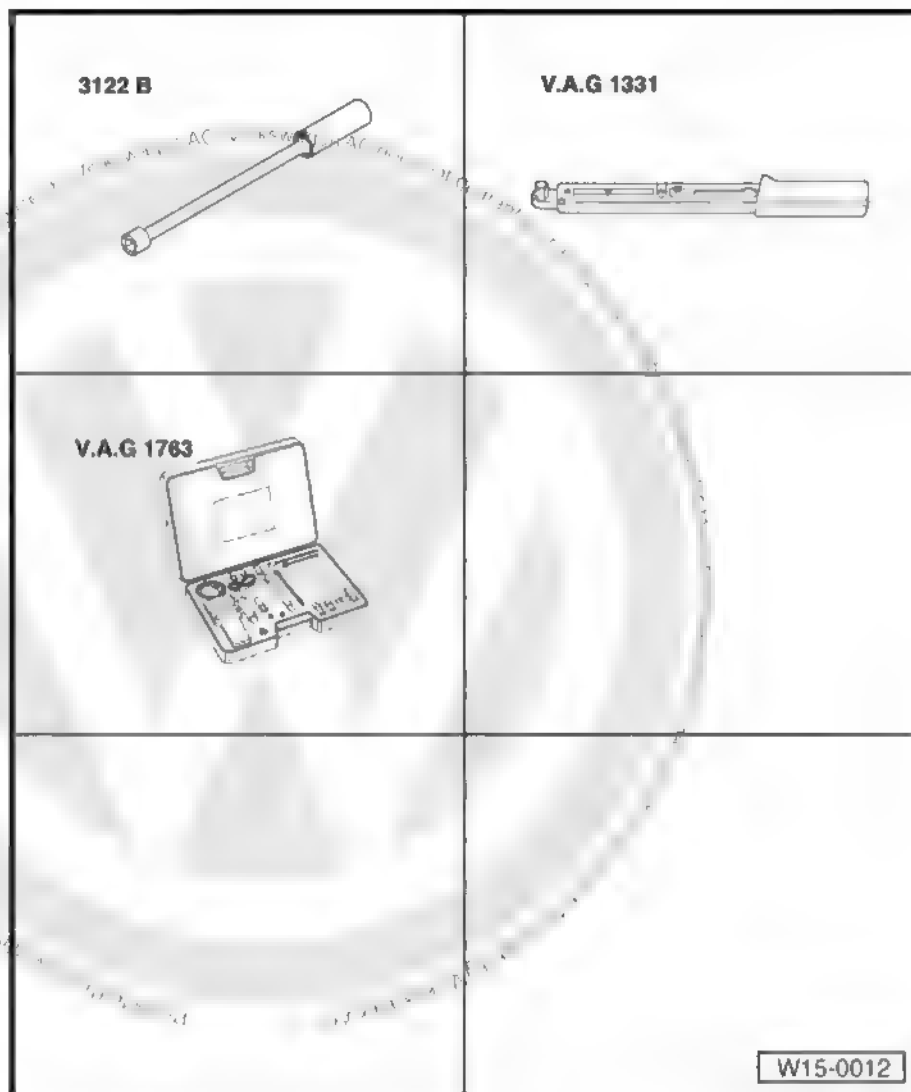
How to install the toothed belt and set the camshaft timing
⇒ [page 52](#) .

Fill cooling system with new coolant ⇒ [page 96](#) .

- Consult fault memory ⇒ [page 158](#) .



1.4 Compression - check



Special tools and workshop equipment required

- ◆ Plug spanner -3122B-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Cylinder compression measurement - gasoline/alcohol -VAG 1763-
- ◆ Extractor -T10029-

Test conditions

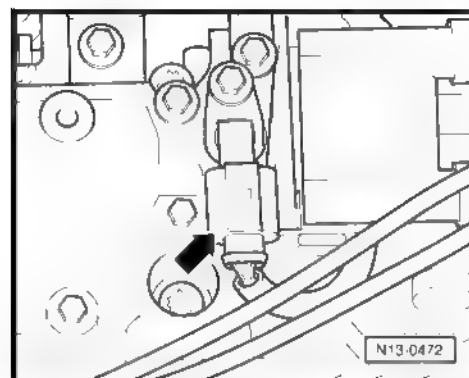
- Engine oil temperature shall be minimum 30 °C.
- Tension of the Battery -A- must be at least 11.5 Volts.
- All electric components, e.g. lights and rear window defogger, must be switched off
- If the vehicle is equipped with air conditioning, it shall be switched off.

1.4.1 Check

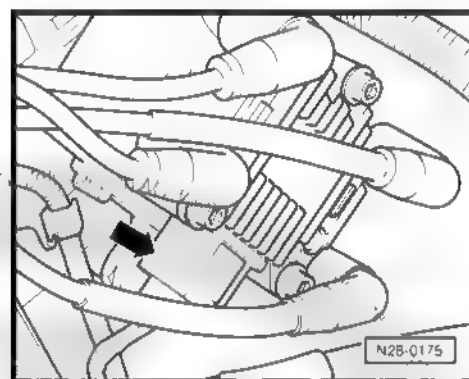
- Remove air filter housing ➤ [page 144](#) .



- Remove Spark plugs -Q- with Plug spanner -3122B- .
- Disconnect the 3-pole connector from flange Hall sender - G40- -arrow-



- Disconnect the 4-pole connector from flange Ignition transformer -N152- -arrow-



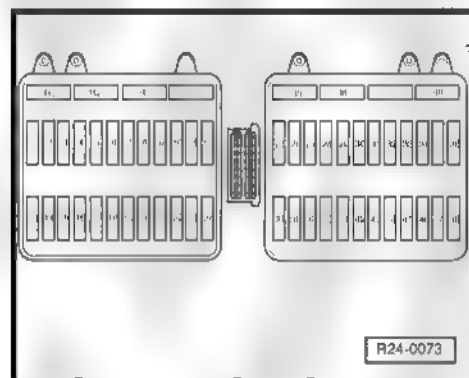
- Remove fuse 33 from fuse box.



Note

When fuse 33 is removed, power supply to injectors is interrupted.

- Check compression with Cylinder compression measuring device - gasoline/alcohol/Diesel -VAG 1763- or Adapter for VAG 1763 -VAG 1381/12- .



Note

Testing equipment operation is described in the respective operation instructions.

- Ask a second mechanic to press the accelerator pedal to open the acceleration valve (throttle) completely.
- Start the start engine until no increase of pressure in the testing equipment is seen.

Compression values

Engine code		BAH, BLH, BJA, BPA and CFZA
Cylinder compression	bar	10.0 to 15.0
Wear limit	bar	7.0
Maximum compression difference between cylinders	bar	3.0



Engine code		CCRA
Cylinder compression	bar	16.0 to 19.0
Wear limit	bar	11.0
Maximum compression difference between cylinders	bar	3.0

- Install the claws from the Spark plugs -Q- with Plug spanner -3122B- and tighten to 30 Nm.
- Check the fault memory, eliminate possible present failures and then erase it ⇒ [page 158](#).



2 Servicing camshaft - replace



Note

- ◆ Heads with cracks between valve seats or between valve seat and thread for the Spark plugs -Q- may still be used without loss of service life, if cracks are small, with a maximum width of 0.5mm or if only the first threads for the Spark plugs -Q- show cracks.
- ◆ Prior to the assembly work, it is necessary to lubricate the support and slide surfaces.
- ◆ With the head off, use Thrust plate -VW 5541/3- to fasten the head and valve support.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1 - Camshaft

- ☐ Check axial clearance
⇒ [page 67](#).
- ☐ Remove and install
⇒ [page 72](#).
- ☐ Measure the axial clearance with Plastigage, wear limit: 0.10 mm.
- ☐ Eccentricity: max. 0.05 mm.
- ☐ Code ⇒ [page 67](#)

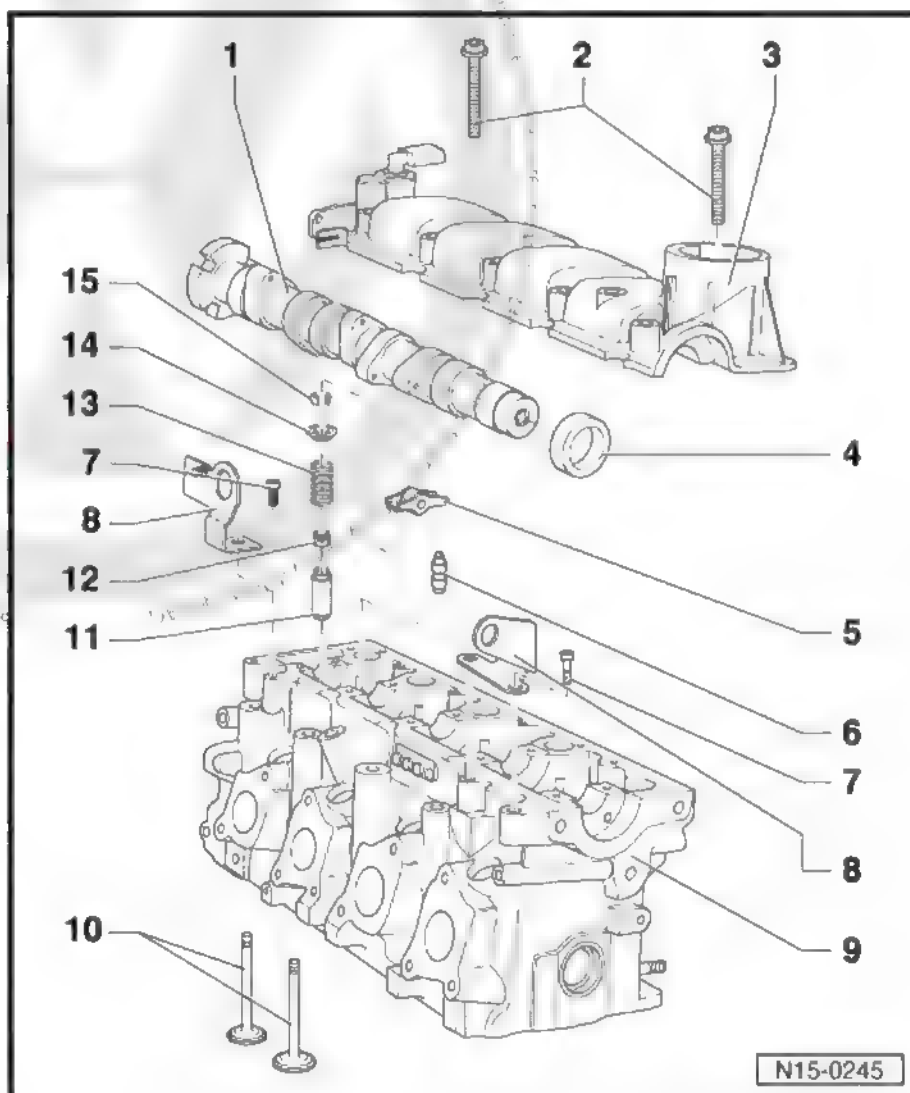
2 - 6 Nm + 90°

- ☐ Renew each time after removing.
- ☐ Follow installation instructions and sequence when loosening and tightening
⇒ [page 72](#).

3 - Cylinder head cover

- ☐ Support surface with head cannot be worked.
- ☐ With integrated camshaft bearings.
- ☐ Cylinder head and cover are a pair, therefore, the pair engravings are located on the exhaust manifold side, next to the Hall sender -G40-.
- ☐ Remove all seal residues.
- ☐ Apply the Engine sealant -AMV 188 001 02- before positioning it.

- ☐ For assembly, position vertically from above with the guide pins in the cylinder head holes.



N15-0245



- ☐ Removal and installation ➔ [page 72](#) .

4 - Camshaft seal

- ☐ Apply oil lightly on the sealing ring lips.
- ☐ Replace ➔ [page 70](#) .

5 - Rocker with roller

- ☐ Check free rocker operation.
- ☐ Lubricate sliding surface.
- ☐ For installation, loosen the safety clip of the support element.

6 - Support element

- ☐ Do not change operation position.
- ☐ With hydraulic offsetting of valve gap.
- ☐ Lubricate sliding surface.

7 - 25 Nm

- ☐ Renew each time after removing.

8 - Support for engine fixing/holding

- ☐ Number of replacement parts: Support -030 103 390 F- (on the pulley side) Support -030 103 390 G- (engine steering side).

9 - Engine head

- ☐ Support surface with cover cannot be worked.
- ☐ Cylinder head and cover are a pair, therefore, the pair engravings are located on the exhaust manifold side, next to the Hall sender -G40- .
- ☐ Grind the valve seat ➔ [page 68](#) .
- ☐ Grind the seal surface on the engine block side ➔ [page 67](#)

10 - Valves

- ☐ Do not grind, only seating is allowed.
- ☐ Valve dimensions ➔ [page 68](#)
- ☐ Remove with Device -2036- and Thrust plate -VW 5541/3- .

11 - Valve guide

- ☐ Check ➔ [page 74](#) .

12 - Valve stem seal

- ☐ Replace ➔ [page 76](#) .

13 - Valve spring

- ☐ With the head installed, remove with Compressing device -2037- ➔ [page 76](#) . With the head off: Thrust plate -VW 5541/3- .

14 - Spring plate

15 - Cotters



Note

With the head off, use Thrust plate -VW 5541/3-.

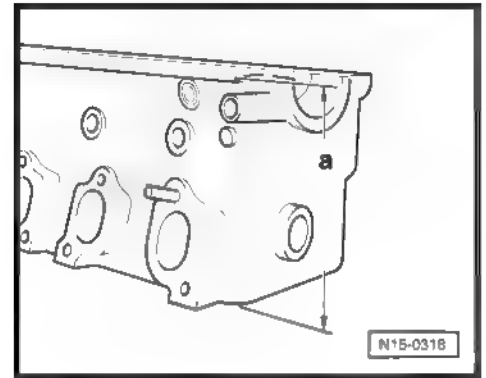
Grind the seal surface on the engine block side

Cylinder head grinding measurements:-nd- = minimum 135.6 mm



Note

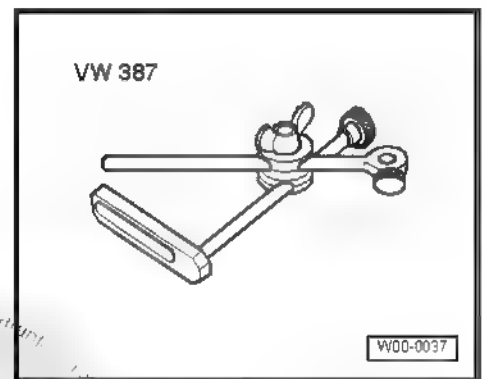
When grinding the surface, valve seats must be reworked to the same dimensions, otherwise valves may hit pistons. Observe minimum quota allowed.



2.1 Camshaft - check axial clearance

Special tools and workshop equipment required

- ◆ Support -VW 387-



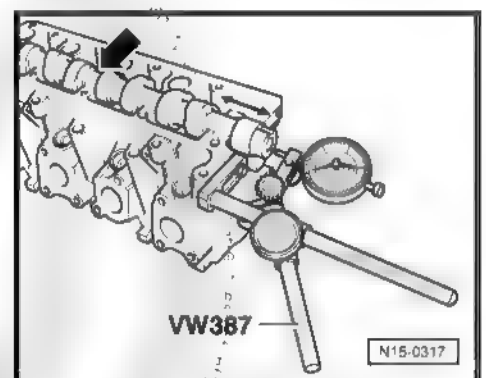
- ◆ Dial gauge

Check

Measure with the support elements and valve drive shaft cover removed.

- Put pressure on the camshaft at the central bearing -arrow- and check axial clearance by longitudinal camshaft movement.

Wear limit: max. 0.15 mm.



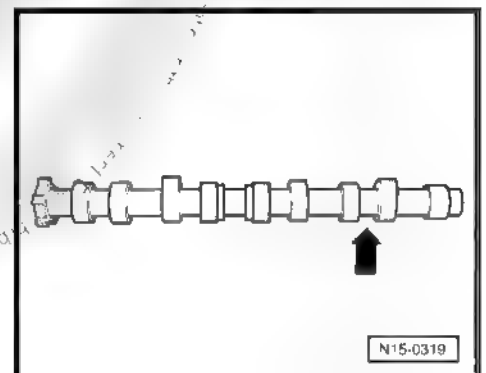
Camshaft code

Engines BAH, BJA, BPA, BLH, and CFZA

Code between intake and exhaust cams of cylinder 1	
Cylinder 1 -arrow-	032 AF

CCRA Engine

Code between intake and exhaust cams of cylinder 1	
Cylinder 1 -arrow-	030 CF





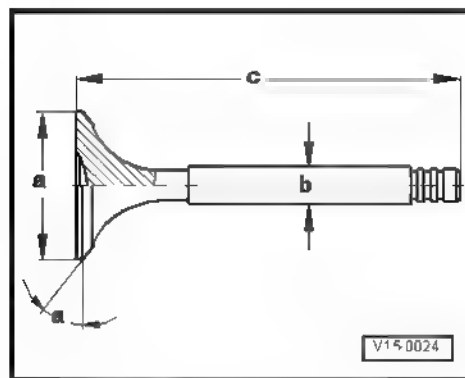
Valve dimensions



Note

Valve grinding (rectifying) is not allowed. They may only be seated

Dimensions		Intake valve	Exhaust valve
Ø a	mm	34,5	28,0
Ø b	mm	5,98	5,96
c	mm	99,25	99,25
α	°	45	45



2.1.1 Distribution time for 1 mm valve clearance

Engines BAH, BLH, BJA, BPA and CFZA

		Intake valve	Exhaust valve
Opens afterwards	PMS	13,0°	-----
Closes afterwards	PMI	38,0°	-----
Opens before	PMI	-----	49,0°
Closes before	PMS	-----	4,0°

CCRA Engine

		Intake valve	Exhaust valve
Opens afterwards	PMS	9,0°	-----
Closes afterwards	PMI	34,0°	-----
Opens before	PMI	-----	33,0°
Closes before	PMS	-----	8,0°

2.2 Valve seat - rework

Special tools and workshop equipment required

- ◆ -Depth dimension-
- ◆ -Valve seat emery-



Note

- ◆ When repairing engines that contain leaking valves, grinding or replacing the valve seats and valves is not sufficient. Valve guides must especially be checked for wear in high mileage engines → [page 74](#).
- ◆ The valve seats should only be reworked just enough to produce a perfect seating pattern. Before submitting to grinding, it is necessary to calculate maximum allowable grinding specification. If grinding specifications are exceeded, it will not be possible to ensure the hydraulic compensation function for the valve gap and, therefore, the head will have to be replaced.

2.2.1 Calculate maximum allowable reworking specification

- Install valve and firmly press it against valve seat.

Note

In case of valve replacement during repairs, use the new valve for measurement.

- Measure distance -nd- between the end of the valve and the upper surface of the cylinder head.
- Calculate the maximum grinding measurement of the measured distance and the minimum distance.

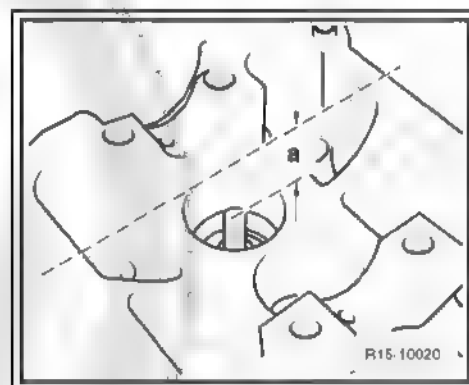
Minimum measurements: Intake valve and exhaust valve 32.1 mm.

Measured distance minus minimum distance = Maximum permissible grinding measurement.

For example:

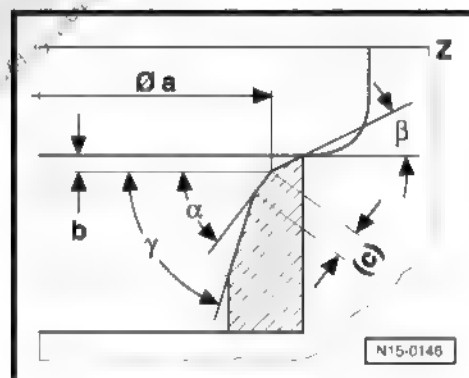
- Measured distance	32,5 mm
Minimum specification:	32,1 mm
= Max. permissible grinding specification ¹¹⁾	0,4 mm

11) The max. permissible grinding measurement is shown in the illustrations to grind the valve seats as measurement "b".



2.2.2 Intake valve seat - machine

- nd = \varnothing 32.9 mm
- b = maximum allowable reworking specification
- c = max. 1.8...2.0 mm
- Z = Lower head edge
- α = 45° Valve seating angle
- β = 30° Upper correction angle
- γ = 60° Lower correction angle



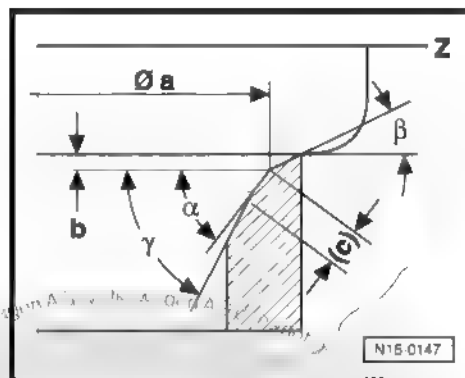
Note

In case of valve seat rings with narrowing, grinding is only allowed if it does not damage this narrowing.

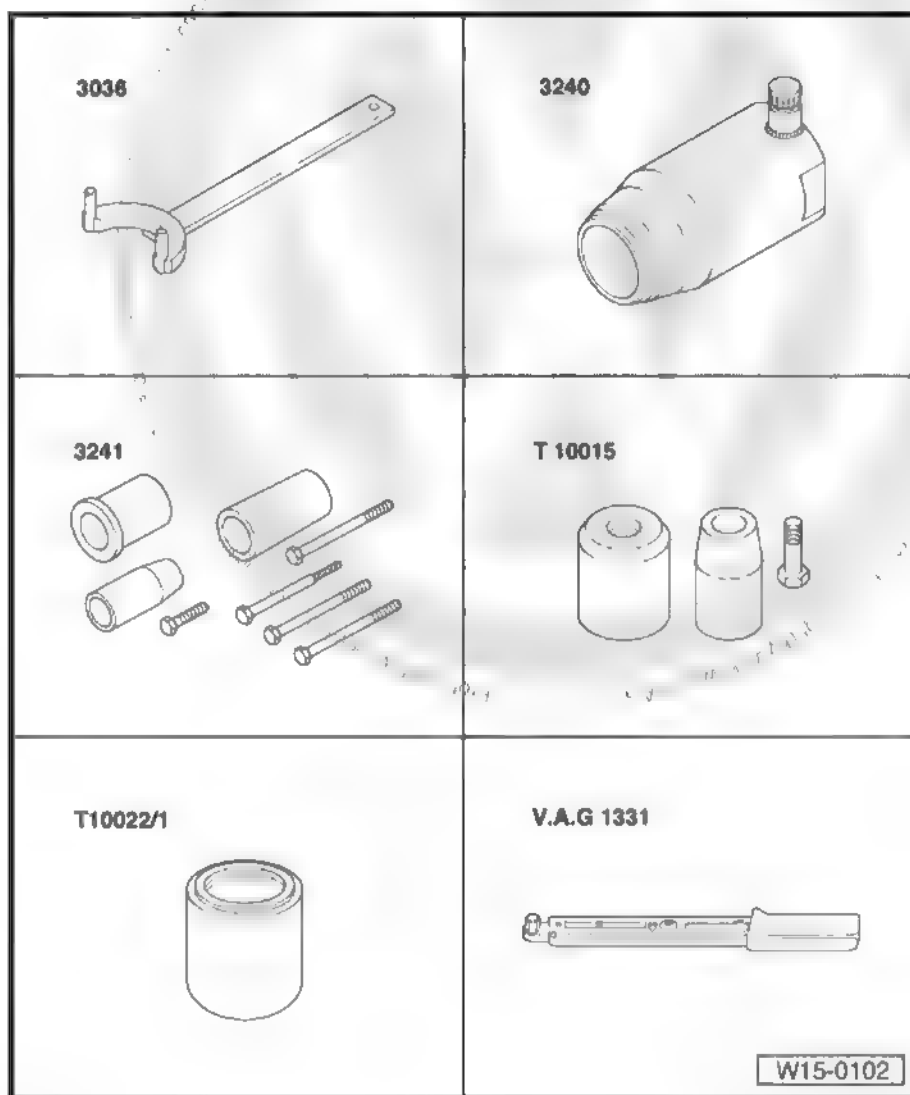


2.2.3 Grinding exhaust valve seat

- nd = \varnothing 26.6 mm
b = maximum allowable reworking specification
c = max 1.8...2.0 mm
Z = Lower head edge
 α = 45° Valve seating angle
 β = 30° Upper correction angle
 γ = 60° Lower correction angle



2.3 Camshaft seal - replace



Special tools and workshop equipment required

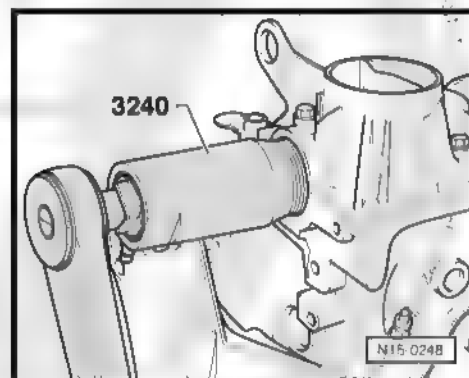
- ◆ Retainer -3036-
- ◆ Extractor -3240-
- ◆ Fitting sleeves -3241-
- ◆ Fitting tool -T10015/3-



- ◆ Sleeve -T10022/1-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-

2.3.1 Removal

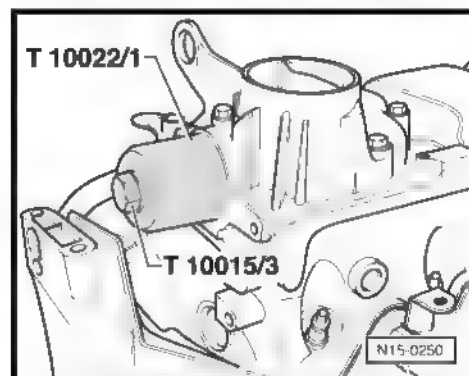
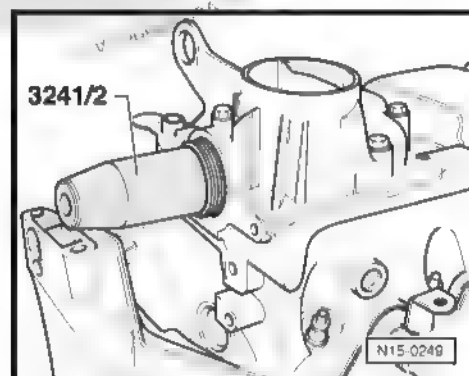
- Remove toothed belt → [page 52](#) .
- Remove camshaft sprocket. To loosen the screw, lock the camshaft gear with the Retainer -3036- .
- Remove the mechanical distribution rear cover.
- As a guide for the seal extractor, install the camshaft gear screw manually up to the stop at the camshaft.
- Rotate the inner part of the Extractor -3240- by two full turns (approx. 3 mm) of the inner part and lock by means of the knurled screw.
- Lubricate the threaded head of the extractor, place it in position and screw it in forcing as much as possible on the seal.
- Loosen the knurled screw and turn the inner part against the crankshaft until the oil seal is pulled out.
- Loosen the securing screw used in the camshaft gear.



2.3.2 Installation

- Lubricate slightly with oil on the seal lip.
- Put Fitting sleeves -3241- on the camshaft journal.
- Slide seal over Guide sleeve -3241/2- .
- Remove the Guide sleeve -3241/2- .
- Compress the sealant with Sleeve -T10022/1- and the screw of Fitting tool -T10015/3- to the stop. Place a washer between the pressure sleeve and hexagon screw.
- Install the camshaft gear and tighten the new screw (use Retainer -3036-). Tightening torque: 20 Nm + 90°.
- Continue installation in removal reversed order.

In order to install the tooth belt and adjust the command time → [page 52](#) .

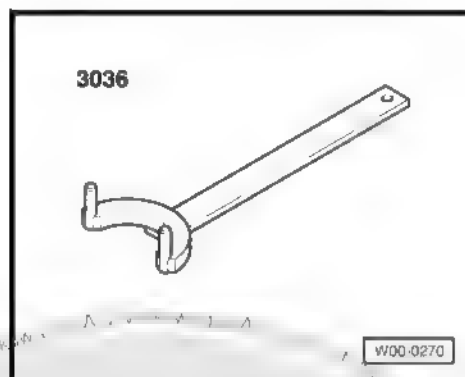




2.4 Head and camshaft cover - remove and install

Special tools and workshop equipment required

◆ Retainer -3036-



◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-



◆ Engine sealant -AMV 188 001 02-

2.4.1 Removal



Note

- ◆ *The seal surfaces on the head cover and the engine head shall not be worked on.*
- ◆ *In this cylinder head, camshaft bearings are integrated in the cylinder head and the head cover. Before removing the head cover, release the toothed belt.*
- ◆ *When releasing the head cover, the camshaft seal must be replaced.*

Sequence of operations



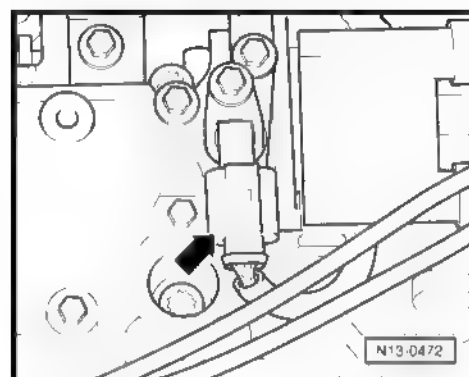
Note

During this work, the earth cable of the Battery -A- must be disconnected. Check whether the vehicle has a coded radio. If this is the case, request the anti-theft code

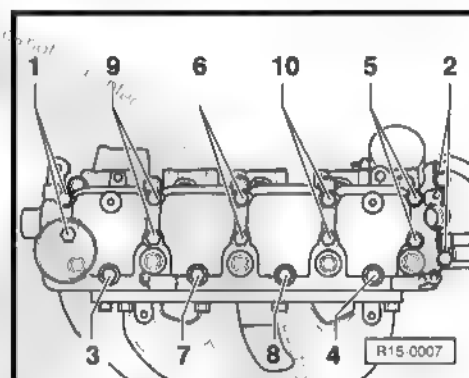
- Disconnect the earth cable from the Battery -A- with the ignition switched off.
- Remove toothed belt [→ page 52](#) .
- Remove camshaft sprocket. To loosen the screw, lock the camshaft gear with the Retainer -3036- .



- Loosen three upper fastening screws of mechanic distribution back cover
- Release the screws from Ignition transformer -N152- from the head cover
- Disconnect the 3-pole connector from flange Hall sender - G40- -arrow-
- Remove oil supply cover from head, disconnect and remove protection.



- Release the head cover fixing screws in the sequence shown, -Item 9 and 10- must be released alternately in a crossed manner.
- Carefully remove the cylinder head cover.
- Carefully remove camshaft through the top and place over clean surface.
- Remove the rockers along with the support elements and place them on a clean surface.
- Watch attentively that the rockers and support elements are not mixed.



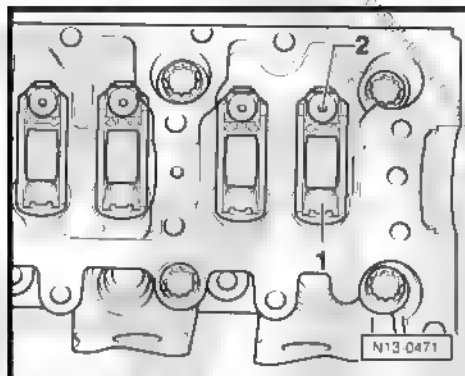
2.4.2 Installation

Prerequisites:

- Avoid penetration of dirt and Engine sealant residues -AMV 188 001 02- into the cylinder head.
- The sealing surfaces must be free from oil and grease.
- For cylinder head cover and camshaft installation, the cylinder 1 cams must point upwards.
- The pistons shall not meet at PMS.
- Eliminate all residues of Engine sealant residues -AMV 188 001 02- from cylinder head and head cover using liquid solvent.
- Lubricate the sliding surfaces of the camshaft.
- Place the support elements on the engine head and its respective rockers.



- Make sure the rockers have been positioned properly on the tips of valves -1- and that the respective support elements -2- are properly engaged.
- Carefully install camshaft into the bearings of the engine head.

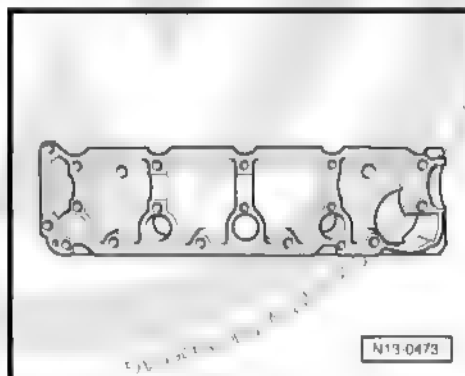


- Apply a thin, uniform film of Engine sealant -AMV 188 001 02- on the clean sealing surface of the head's cover.



Note

A Engine sealant -AMV 188 001 02- must not be applied very thickly, otherwise the Engine sealant -AMV 188 001 02- in excess may enter the lubrication channels or camshaft bearings, damaging the engine.

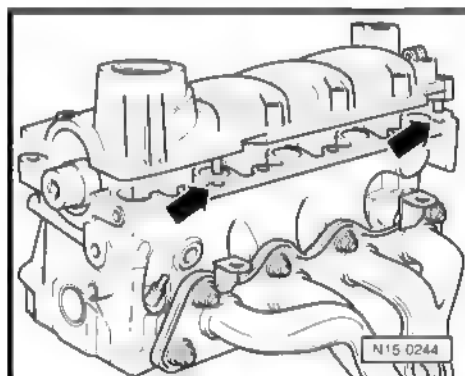


- Carefully place the cylinder head cover vertically over the upper part with the guide pins in the engine head holes -arrows-.



Note

- ◆ *Placing and fixing the cylinder head cover shall be performed without any interruptions, as the seal surfaces start hardening as soon as they touch each other.*
- ◆ *The head cover screws must be replaced.*

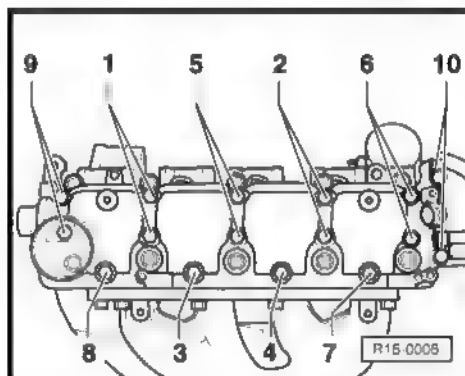


- Firstly, tighten the screws of -Item 1st and 2- tighten using diagonal sequence to 6 Nm.
- Next tighten the other bolts in the indicated sequence with 6 Nm.
- Then tighten all screws by another 90°.



Note

After installing the head cover, the Engine sealant -AMV 188 001 02- should be allowed to dry for approx. 30 minutes.



- Install the new camshaft seal [→ page 70](#) .
- Continue installation in removal reversed order.

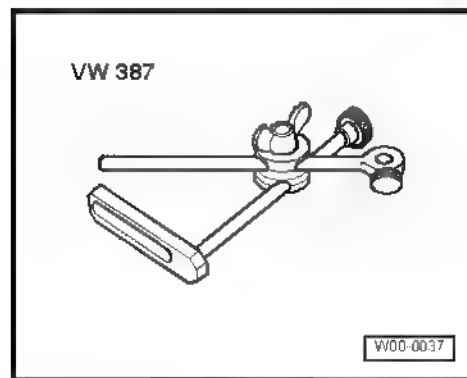
To install the toothed belt and set the camshaft timing
[→ page 52](#) .

2.5 Valve guides - check

Special tools and workshop equipment required



◆ Support -VW 387-



◆ Dial gauge

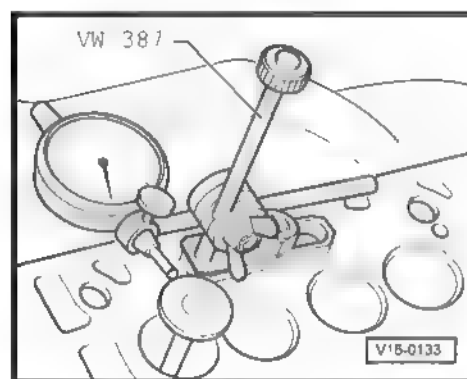
Test sequence

- Place a new valve on the guide. The valve tip shall fit the guide. Due to different valve guide diameters, only use an intake valve in the intake guide and an exhaust valve in the exhaust guide.

- Determine the folding clearance. Wear limit: 0.8 mm.

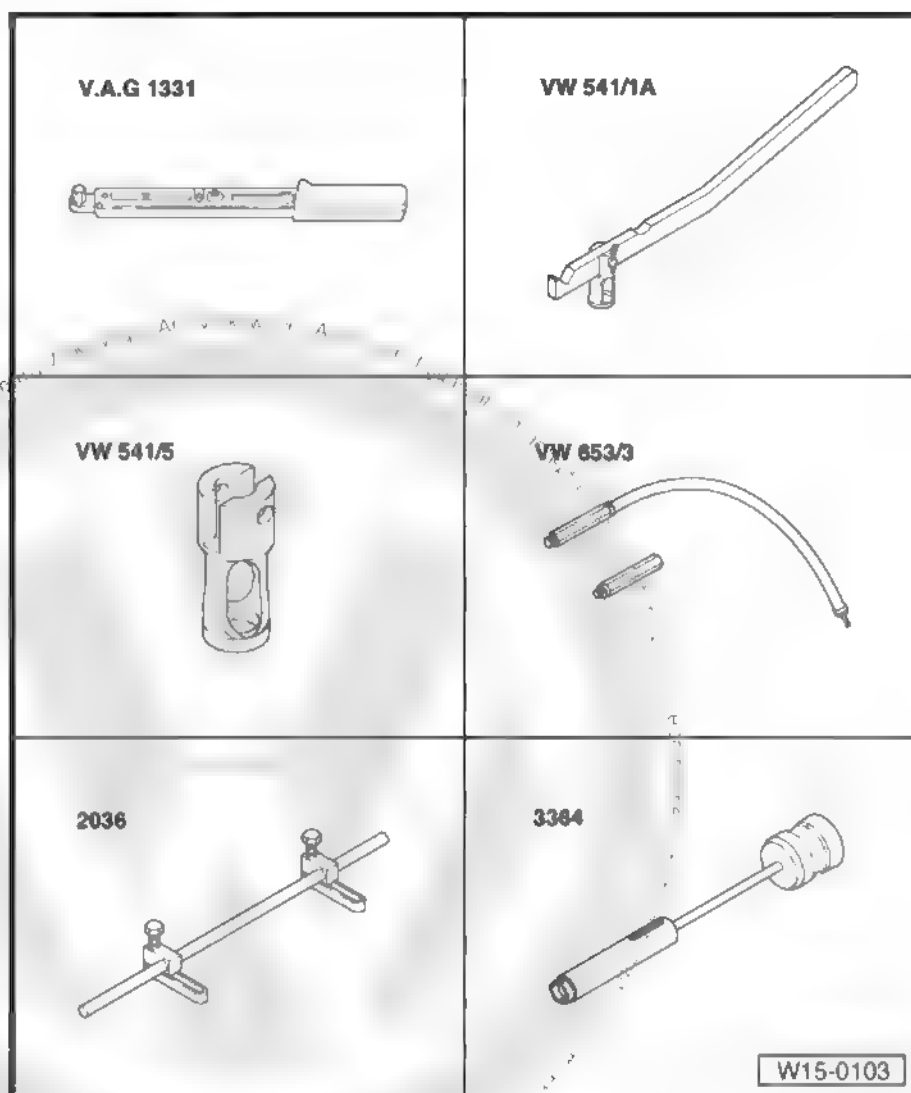
In case the clearance is surpassed:

- Replace the engine head.





2.6 Valve stem seal - replace

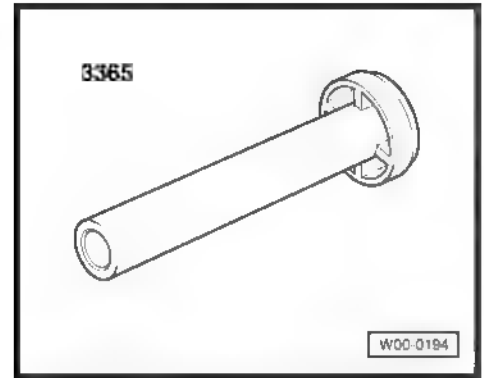


Special tools and workshop equipment required

- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Lever -VW 541/1A-
- ◆ Flexible tube -VW 653/2A (VWB) - or - VW 653/3-
- ◆ Device -2036-
- ◆ Puller -3364-

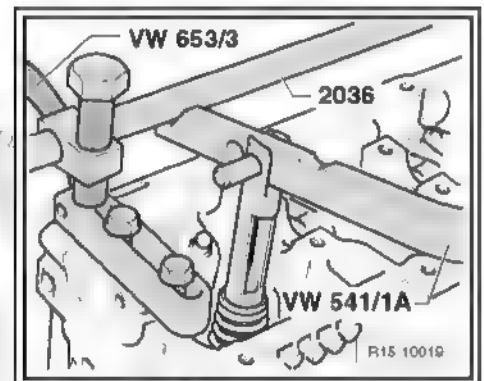


◆ Fitting tool -3365-



2.6.1 Removal

- Remove toothed belt ⇒ [page 52](#) .
- Remove camshaft ⇒ [page 72](#) .
- Remove the rockers along with the support elements and place them on a clean surface.
- Watch attentively that the rockers and support elements are not mixed.
- Remove Spark plugs -Q- .
- Place the piston of the respective cylinder at "lower neutral point".
- Fasten the Device -2036- on the head with the screws used in the cylinder head cover.
- Screw in Flexible tube -VW 653/2A (VWB) - or - VW 653/3- to the threads for the Spark plugs -Q- .
- Connect the pressure hose with compressed air of a minimum 6 bar pressure.
- Remove the valve springs with Lever -VW 541/1A- and Press tool for VW 541/1 A and 2037 -VW 541/5- .



Note

Stuck valve cotters may be released with gentle hammer taps on Lever -VW 541/1A- .

- Remove the valve sealant with Puller -3364- .

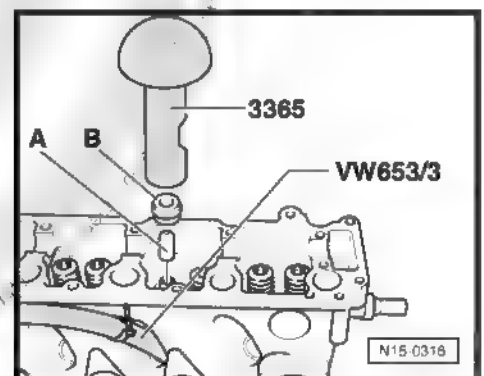
2.6.2 Installation

- Place the plastic sleeve provided -A- on the respective valve guide. This measure avoids damage to the new valve seal -B-.
- Put the new sealant on the compressor valve with Fitting tool -3365- .
- Lubricate the seal lip of the seal and carefully displace it in the valve guide.

Install head cap.

- Installing and adjusting toothed belt ⇒ [page 52](#) .

Proceed installation in removal reverse order





17 – Lubrication system

1 Lubrication system components - remove and install



Note

Oil level must not exceed Max marking because of risk of damage to the catalyzer. Marks ➔ [page 81](#)

Check oil pressure ➔ [page 87](#) .

Oil filling quantities

with oil filter 4.0 l

12) Current values: ➔ Emissions test folder

Engine oil specification:

Use highly lubricant oils, as per specification VW 502 00 ➔
Chemical Materials Manual



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.



1 - Oil pressure switch from 0.3...0.6 bar -F1-, 25 Nm

- ☐ In case of leakage, cut and replace the sealing ring.
- ☐ Tightening torque 17...23 Nm.
- ☐ Check → [page 87](#).

2 - Guide tube

3 - Self-threading screw

- ☐ 3 Nm
- ☐ Screwer maximum rotation: 200 rpm.
- ☐ Fastening on intake manifold.

4 - Oil filler cap

- ☐ Replace the seal if damaged.

5 - Guide tube funnel

- ☐ Remove to aspirate the oil.

6 - ?Oil dipstick

- ☐ The oil level must not exceed the Max mark.
- ☐ Marks → [page 81](#)

7 - Camshaft gear

- ☐ Observe installation position of toothed belt → [page 52](#).

8 - To intake manifold

9 - Oil filter

- ☐ Loosen by the hexagon with the vehicle on the ground.
- ☐ Tighten manually.
- ☐ Observe the oil filter installation instructions.

10 - Gasket

- ☐ Replace.
- ☐ Must seat properly on the guides.

11 - Tensioner pulley

- ☐ Check → [page 49](#).
- ☐ Toothed belt - remove and install, adjust → [page 52](#).

12 - 20 Nm

13 - Toothed belt

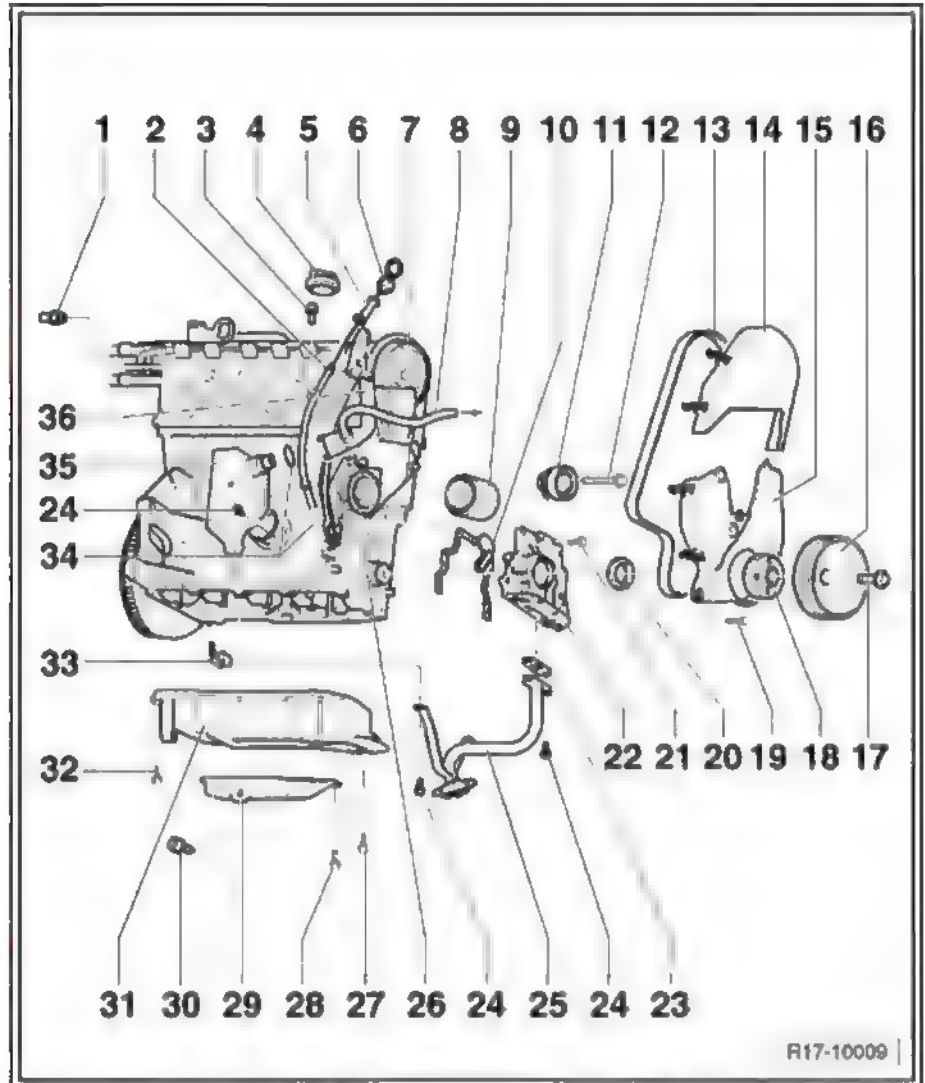
- ☐ Mark turning direction before removal.
- ☐ Check for visible wear
- ☐ Do not fold.
- ☐ Remove and install, adjust → [page 52](#).

14 - Upper cover of mechanical distribution system

15 - Mechanical distribution lower cover

16 - Crankshaft pulley

- ☐ Observe fastening during installation.



R17-10009



- ☐ Removal and installation ➔ [page 52](#) .
- ☐ Remove and install Poly-V belt ➔ [page 21](#) .

17 - 90 Nm + 90°

- ☐ Renew each time after removing.
- ☐ To loosen and tighten, lock with the Wrench -3415- .
- ☐ The angular torque can be performed in several stages.
- ☐ The angular torque can be measured with a regular angle measuring disc, e.g. Hazet 6690.

18 - Crankshaft gear

- ☐ Observe installation position of toothed belt ➔ [page 52](#) .

19 - 10 Nm

20 - ?Sealant

- ☐ Replace ➔ [page 28](#) .

21 - 10 Nm

22 - Crankshaft flange (pulley side) / oil pump

- ☐ Replace complete set only.
- ☐ Must seat on adjustment guides.
- ☐ In order to remove and install, remove the sump.
- ☐ Carefully watch the crankshaft drag element during installation.
- ☐ Remove and install the oil pump ➔ [page 84](#) .

23 - Gasket

- ☐ Replace.

24 - 10 Nm

25 - Oil sucking tube

- ☐ Clean mesh filter if necessary.

26 - Sliding element

- ☐ Lubricate with oil before installing oil pump.

27 - 10 Nm + 90°

- ☐ Renew each time after removing.
- ☐ Release the oil sump/engine block fixing bolts on the pulley side (4 units), inside the oil sump.

28 - 15 Nm

29 - Oil sump cover

- ☐ Clean all sealing surfaces before installation.
- ☐ Install with Silicon engine seal -D 176 404 A2- .
- ☐ Removal and installation ➔ [page 81](#) .

30 - Oil draining plug

- ☐ 30 Nm
- ☐ With integrated sealing ring
- ☐ Replace.

31 - Sump

- ☐ Two parts
- ☐ Clean all sealing surfaces before installation.
- ☐ Install with Silicon engine seal -D 176 404 A2- .
- ☐ To remove and install, remove the oil sump cover.
- ☐ Removal and installation ➔ [page 81](#) .

32 - 10 Nm + 90°

- ☐ Renew each time after removing.



33 - Oil valve and injector

- ☐ Only engines CCRA and CFZA.
- ☐ For piston cooling
- ☐ The entire assembly is tested at the factory to ensure 1.5 to 1.9 bar opening pressure, and the shape and direction of oil blast.
- ☐ Ejectors are pressure-fastened onto engine block in the bushing seating area of main bearing shells, and must not be removed.

34 - Seal ring

- ☐ Replace.

35 - Oil sump ventilation device

36 - To the air cleaner

Oil level measurement rod marks

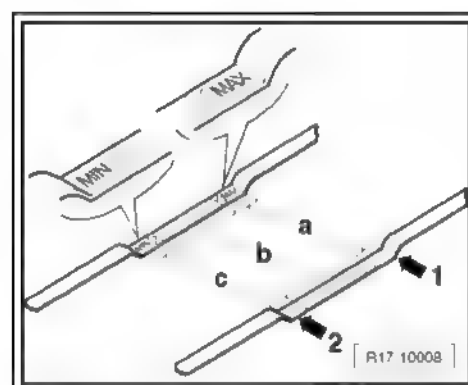
1 - Max. mark

2 - Min. mark

nd - Area between the upper edge of the printed area and max. mark: do not refill with oil.

b - Oil level in the marked area: May be filled with oil.

c - Area between the min. mark and the lower corner of the marked area: Refill with max. 0.5 l of engine oil.



1.1 Oil sump - remove and install

Special tools and workshop equipment required

- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-



- ◆ Portable drill with plastic brush
- ◆ Flat spatula
- ◆ Safety goggles
- ◆ Silicon engine seal -D 176 404 A2-

1.1.1 Removal

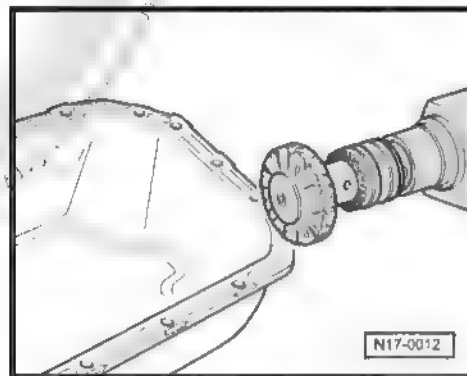
- Remove engine bulkhead⇒ Body Repairs: Rep. Gr 50 ; Body - Front part .
- Release the exhaust pipe's manifold exhaust tube
→ [page 161](#) .
- Drain the engine oil.



Note

Respect the oil disposal regulations!

- Remove the oil sump cover.
- Remove the four internal sump fixing screws, on the pulley side.
- Remove the two connection screws from the clutch housing for oil sump bracket
- Now release all remaining oil sump fixing screws.
- Remove the oil sump. If necessary, loosen the oil sump by slightly hitting it with a rubber hammer.
- Eliminate all residues of Silicon engine seal -D 176 404 A2- still remaining in the engine block, using a flat scraper.
- Eliminate all residues of Silicon engine seal -D 176 404 A2- from oil pan and oil pan cover using a rotary brush, e.g. a plastic brush attached to a portable drill (wear goggles).
- Clean the seal surfaces. They must be free of oil and grease.



1.1.2 Installation



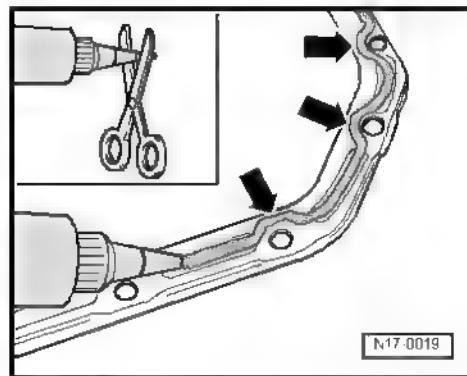
Note

- ♦ *Observe the expiry date of Silicon engine seal -D 176 404 A2-.*
- ♦ *The oil sump and the cover must be installed no more than 5 minutes after the application of Silicon engine seal -D 176 404 A2-.*
- ♦ *Oil sump may be easily and safely installed with threaded screws M 6 on two point of the flange on the engine block.*
- Cut the tube injector at the front mark (\varnothing of the injector is approx. 3 mm).
- Apply the Silicon engine seal -D 176 404 A2- as illustrated on the oil sump's clean sealing surface. The bead of the Silicon engine seal -D 176 404 A2- bead must:
 - ♦ be 2...3 mm thick.
 - ♦ Pass inside screw hole area -arrows-.



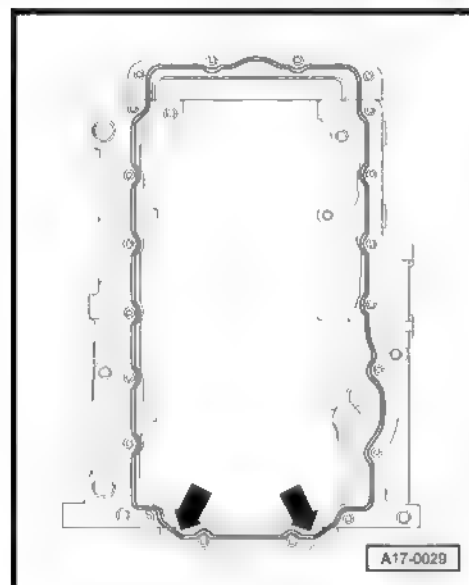
Note

The bead of Silicon engine seal -D 176 404 A2- must not be thicker, otherwise the Silicon engine seal -D 176 404 A2- in excess may reach the oil pan, obstructing the oil aspiration tube filter.





- Apply the Silicon engine seal -D 176 404 A2- , as shown in the illustration, on the clean oil sump sealing surface (the illustration shows the position of the Silicon engine seal -D 176 404 A2- beads on the engine block).
- Immediately install the oil sump and tighten all screws a little
- Tighten the new oil sump screws with 10 Nm
- Then tighten all screws other additional 90°.
- Tighten oil sump/gearbox screws with 40 Nm.

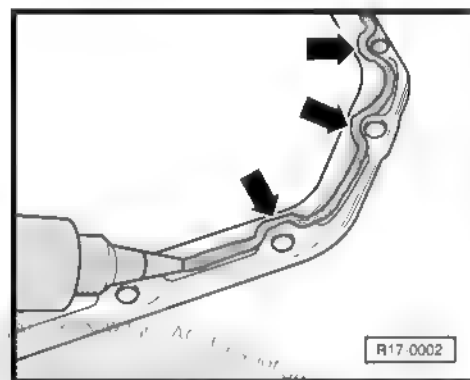


- Apply the Silicon engine seal -D 176 404 A2- as illustrated, on the clean oil sump cover sealing surface. The bead of the Silicon engine seal -D 176 404 A2- bead must:
 - ◆ be 2...3 mm thick.
 - ◆ Pass inside screw hole area -arrows-.



Note

The bead of Silicon engine seal -D 176 404 A2- must not be thicker, otherwise the Silicon engine seal -D 176 404 A2- in excess may reach the oil pan, obstructing the oil aspiration tube filter.



- Immediately install the oil sump cover and tighten all screws a little.
- Then tighten the screws to 15 Nm.

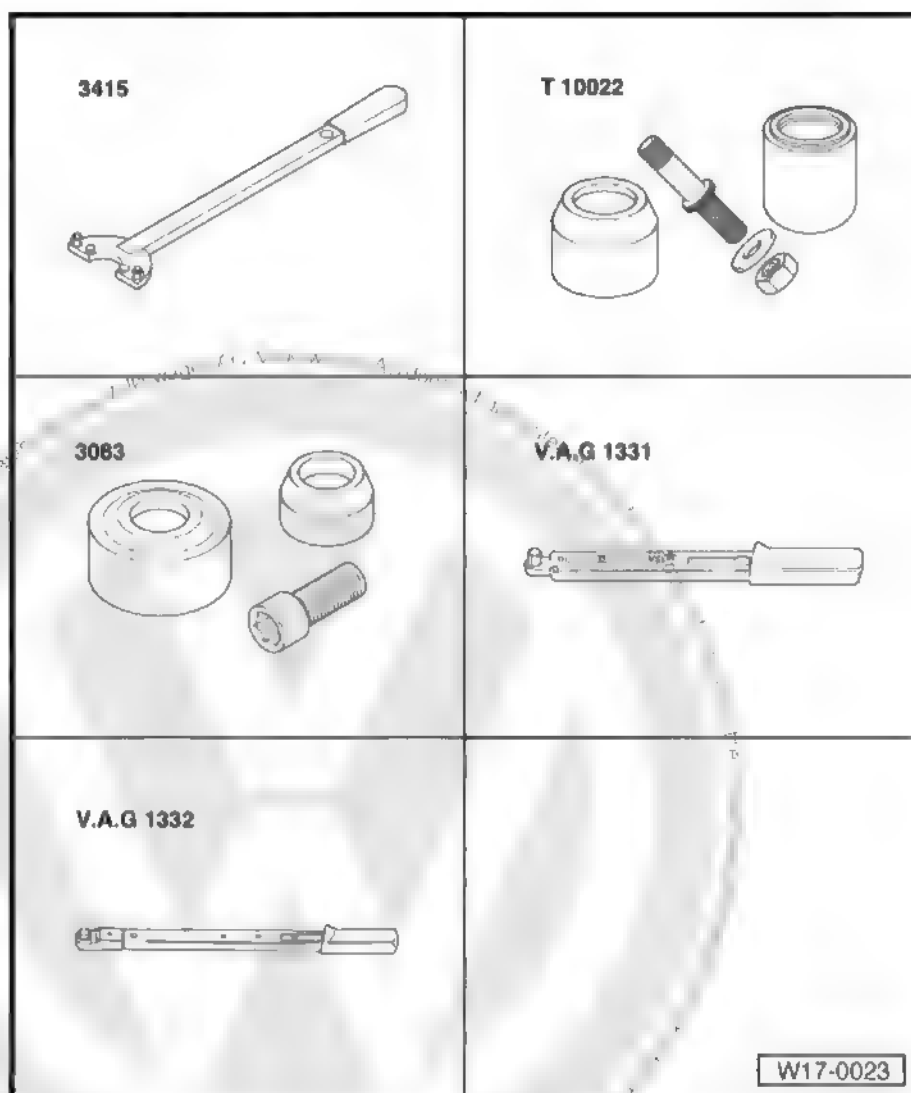


Note

After the oil sump has been installed, the Silicon engine seal -D 176 404 A2- must dry for approximately 30 minutes. After that time, the engine can be refilled with oil.



1.2 Oil pump - remove and install



Special tools and workshop equipment required

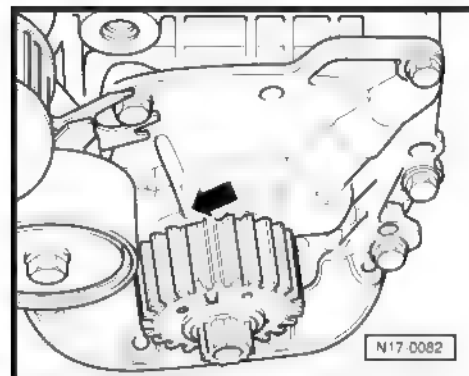
- ◆ Wrench -3415-
- ◆ Joint spanner 10 mm -3220-
- ◆ Assembly sleeve -T10022-
- ◆ Oil seal fitting tool -3083-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-

1.2.1 Removal

- Remove toothed belt → [page 52](#) .



- Place the crankshaft on TDC for cylinder 1 -arrow-: The crankshaft gear's chamfered tooth must coincide with mark "2V" on the oil pump.

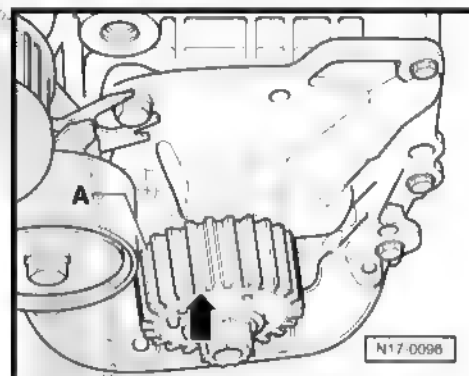


- Turn crankshaft or gear to upper neutral position, counter-clockwise by three teeth: On the right side of the chamfered tooth -A- of the gear, the third tooth -arrow- must be aligned with the UNP mark "2V" on the oil pump housing.



Note

This adjust places crankshaft in position for oil pump installation. One of the four sliding polygonal cams on crankshaft will be on the top.



- Remove the crankshaft gear. To do so, lock the gear with Wrench -3415-.
- Remove the Poly V toothed belt tensioner.
- Remove sump ⇒ [page 81](#).
- Remove the oil suction tube ⇒ [Item 25 \(page 80\)](#).
- Remove the oil pump.
- Remove seal gasket.
- Remove seal residues on engine block with a flat scraper.
- Clean sealing surfaces, which must be free from oil and grease.

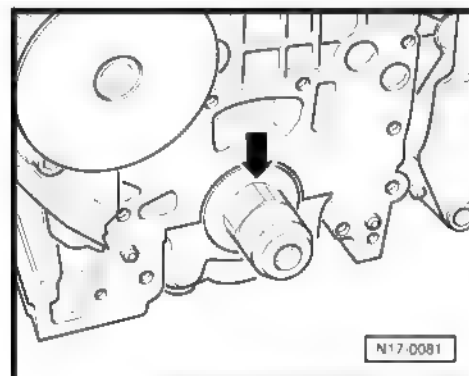


1.2.2 Installation

Prerequisites:

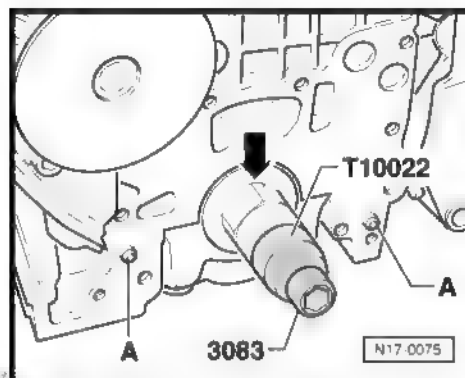
- One of the four sliding polygonal cams on crankshaft shall be on the top.

Sequence of operations:

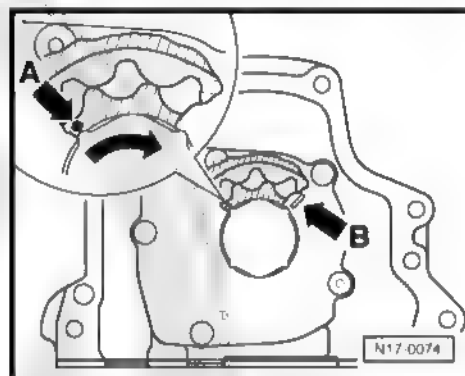




- Position the Crosshead screw of Oil seal fitting tool -3083- with Assembly sleeve -T10022- on the crankshaft and press with your hand.
- Place new sealing joints on guides -A-.



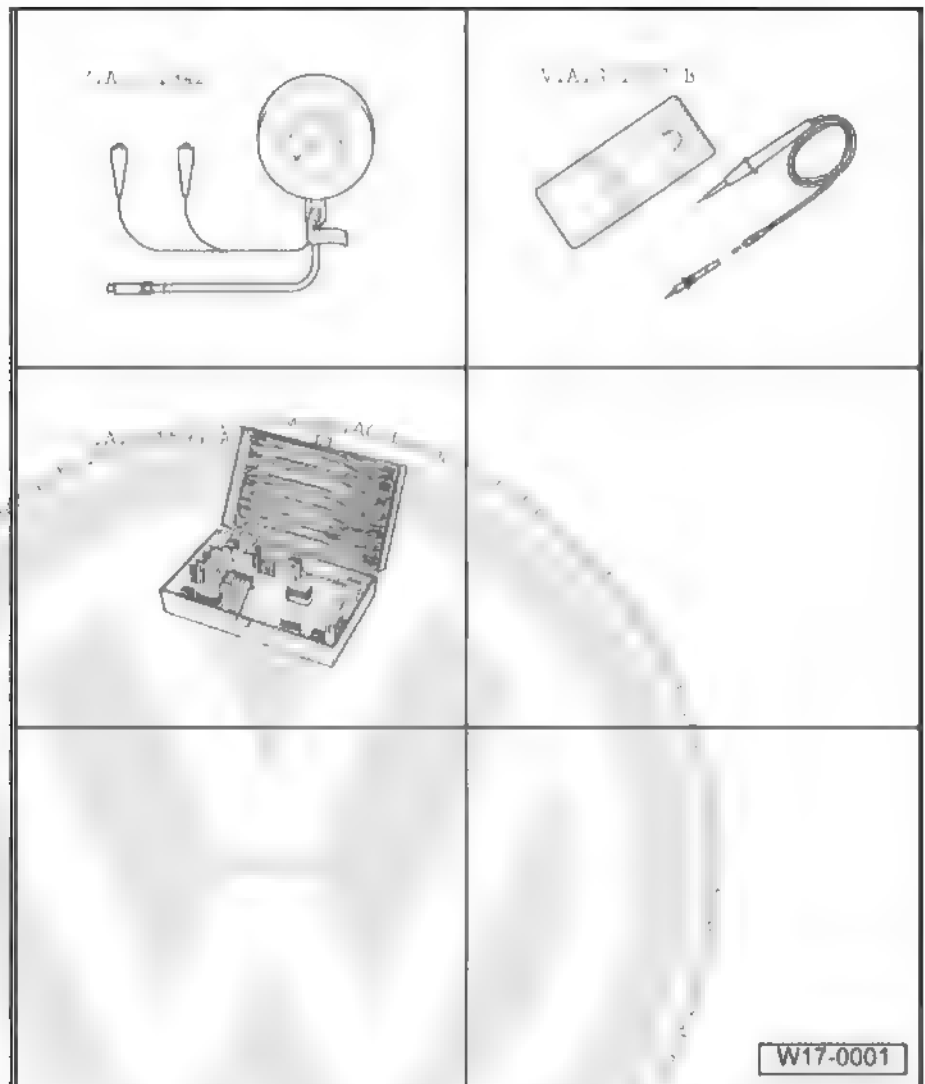
- Place the mark -arrow A- for the internal oil pump rotor in the installation position -mark -arrow B- on the oil pump housing cover.
- Apply oil to the four sliding polygonal cams on crankshaft.
- Carefully place the oil pump on the four sliding polygonal cams on the crankshaft.
- Align internal rotor turning a little on the four sliding polygonal cams on crankshaft.
- Next, carefully place oil pump onto the guides.
- Screw the oil pump. Tightening torque: 10 Nm.
- Remove the Assembly sleeve -T10022-.
- Install the oil suction tube ⇒ [Item 25 \(page 80\)](#).
- Install the oil sump ⇒ [page 81](#).



Install the tooth belt and adjust the distribution timing
⇒ [page 52](#).



1.3 Oil pressure and Oil pressure switch -F1- - Check



Special tools and workshop equipment required

- ◆ Oil pressure tester -VAG 1342-
- ◆ Test probe or VAG 1527B -EQ 7300-
- ◆ Measurement auxiliary cable set -VAG 1594C-

Test conditions:

- Engine oil level in order, check ⇒ [page 81](#)
- The engine's oil temperature must be no less than 80°C (Radiator fan -V7- should have worked once).



Note

Operation and repair test for visual and acoustic oil pressure indicator → Current flow diagrams, Electrical fault finding and Fitting locations



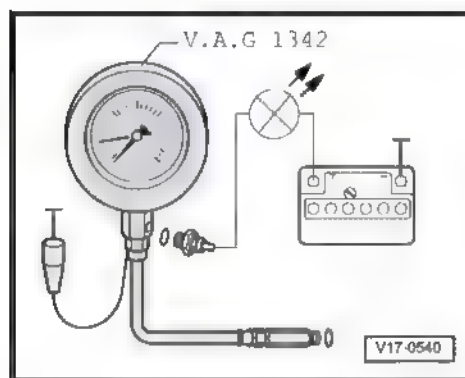
Test sequence:

- Remove the Oil pressure switch -F1- and install on Oil pressure tester -VAG 1342- .
- Install the Oil pressure tester -VAG 1342- instead of Oil pressure switch -F1- in the engine head.
- Connect the brown cable of the Oil pressure tester -VAG 1342- to earth (-).
- Connect the Oil pressure tester -VAG 1342- with Measurement auxiliary cable set -VAG 1594C- to positive of the Battery -A- (+) and to the Oil pressure switch -F1- . Diode lamp must not turn on.
- If the diode lights up, replace the Oil pressure switch -F1- .

If the LED does not light up:

- Keep the engine running and slowly increase rotation. With 0.3...0.6 bar of pressure the LED should light up, otherwise replace oil pressure switch Oil pressure switch -F1- .
- Continue increasing the speed. At 2000 rpm and with an oil temperature of 80°, the oil pressure must be at least 2.0 bar.

At higher rotations, the oil pressure shall not surpass 7.0 bar.





19 – Cooling system

1 Cooling system components - remove and install



WARNING

For installation work, especially in the engine compartment, due to reduced existing space, consider the following:

- ◆ *All hoses (e.g. fuel, hydraulic, activated charcoal filter system, coolant and refrigerant gas, brake fluid, vacuum) and electric cables must be arranged in a way to return to their original positions.*
- ◆ *Ensure easy access to all mobile parts or that may be hot.*



Note

- ◆ *The cooling system is under pressure when the engine is hot. For this reason it is necessary to reduce pressure prior to any repairs.*
- ◆ *Hose unions are fixed by spring clamps. In case of repairs, only use spring clamps.*
- ◆ *To install the spring clamps, it is recommended you use Standard-type clamp pliers -VW 5162- or Standard-type clamp pliers -VAS 5024A- or the Hose clamping pliers -VAG 1921-.*
- ◆ *Install coolant hoses without any tension to avoid contact with other components (observe the cooling system connection marks on the hose).*

Check the cooling system for leaks again with Cooling system tester -VAG 1274- or Cooling system tester -VAG 1274B- and with Adapter for VAG 1274 -VAG 1274/8- and Adapter for VAG 1274 -VAG 1274/9-.

Cooling system components on the body side ⇒ [page 90](#).

Cooling system components on the engine side ⇒ [page 91](#).

Cooling fluid hose connections diagram ⇒ [page 93](#).

Drain and fill the cooling system ⇒ [page 96](#).

Indications for coolant preparation ⇒ [page 96](#).



1.1 Cooling system components on the body side

1 - Radiator

- ☐ Remove and install
→ [page 100](#) .
- ☐ After removal, replace
coolant completely.

2 - Seal ring

- ☐ Replace

3 - Upper coolant hose

- ☐ Fastened to radiator by
a clamp.
- ☐ Ensure proper fasten-
ing.
- ☐ Cooling fluid hose con-
nections diagram
→ [page 93](#) .

4 - Coolant temperature send- er -G62-

- ☐ For the BLH engine on-
ly.
- ☐ With Coolant tempera-
ture display sender -
G2- .
- ☐ To Engine control unit -
J623- .
- ☐ Release system pres-
sure before removal.

5 - Latch

- ☐ For the BLH engine on-
ly.

6 - Air deflector

7 - 10 Nm

8 - Auxiliary blower

- ☐ Exists in some versions only

9 - Clip

- ☐ Ensure proper fastening.

10 - Support

- ☐ Of Radiator fan -V7- .

11 - Connector

12 - Radiator fan -V7-

13 - For cooling system thermostatic valve body

- ☐ Cooling system hose connections diagram → [page 93](#) .

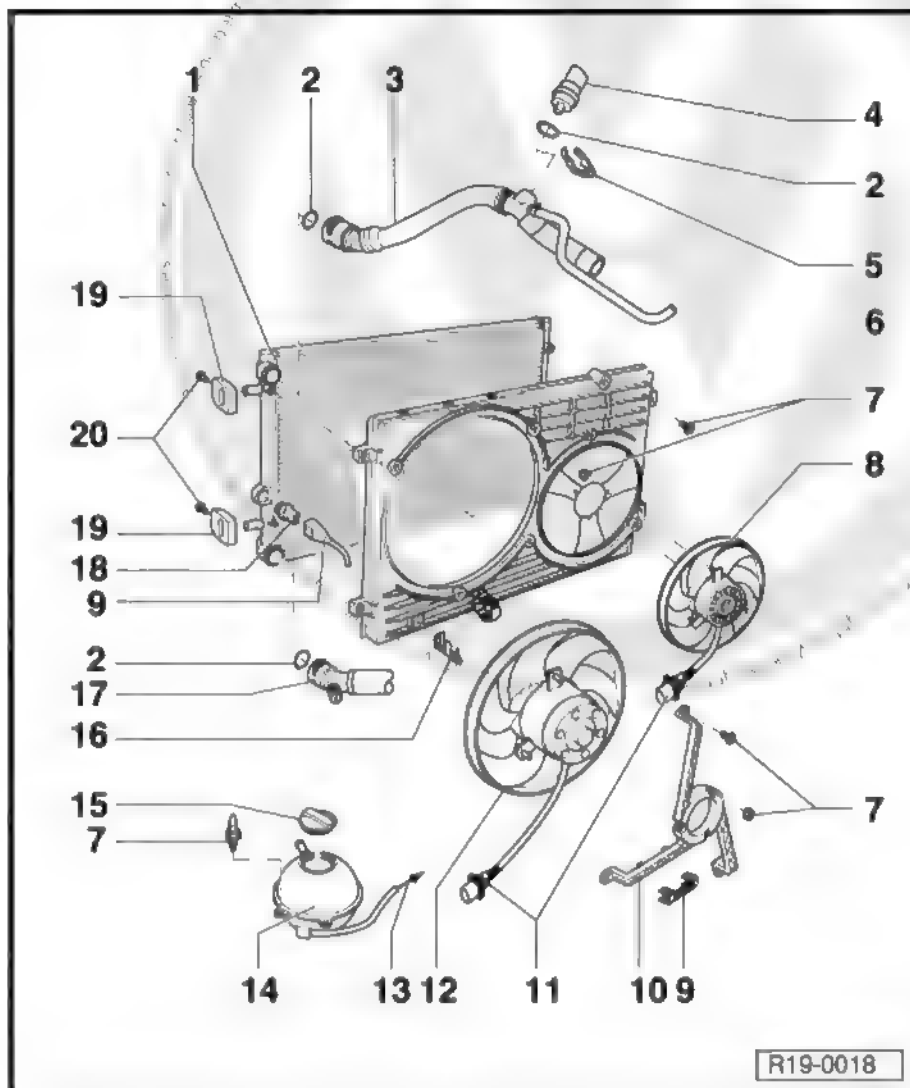
14 - ?Coolant container

Check the cooling system for leaks again with Cooling system tester -VAG 1274- or Cooling system tester -VAG 1274B- with Adapter for VAG 1274 -VAG 1274/8- .

15 - Cover

Check the cooling system for leaks again with Cooling system tester -VAG 1274- or Cooling system tester -VAG 1274B- and with Adapter for VAG 1274 -VAG 1274/9- .

- ☐ Test pressure 1.6 ... 1.8 bar.





16 - Support

- ☐ For the connector of Radiator fan -V7- .

17 - Lower coolant hose

- ☐ Fastened to radiator through retaining fastener.
- ☐ Ensure proper fastening
- ☐ Cooling system hose connections diagram → [page 93](#) .

18 - Radiator fan thermal switch -F18-

- ☐ 35 Nm
- ☐ Of Radiator fan -V7- .
- ☐ Not applicable.

19 - Support

- ☐ for the radiator.
- ☐ Observe installation position.
- ☐ Observe the different models.

20 - 10 Nm

1.2 Cooling system components on the engine side

1 - Flange

2 - 9 Nm

3 - Seal ring

- ☐ Replace.

4 - Thermostatic valve

- ☐ Check the operation:
Heat the valve in water.
Thermal element pin
must move outwards.
- ☐ Temperature test:
Opening start (approx.
84°C) and opening clo-
sure (approx. 98 °C) can
not be performed.

5 - To heat exchanger

- ☐ Cooling system hose
connections diagram
⇒ [page 93](#) .

6 - From coolant container

- ☐ Cooling system hose
connections diagram
⇒ [page 93](#) .

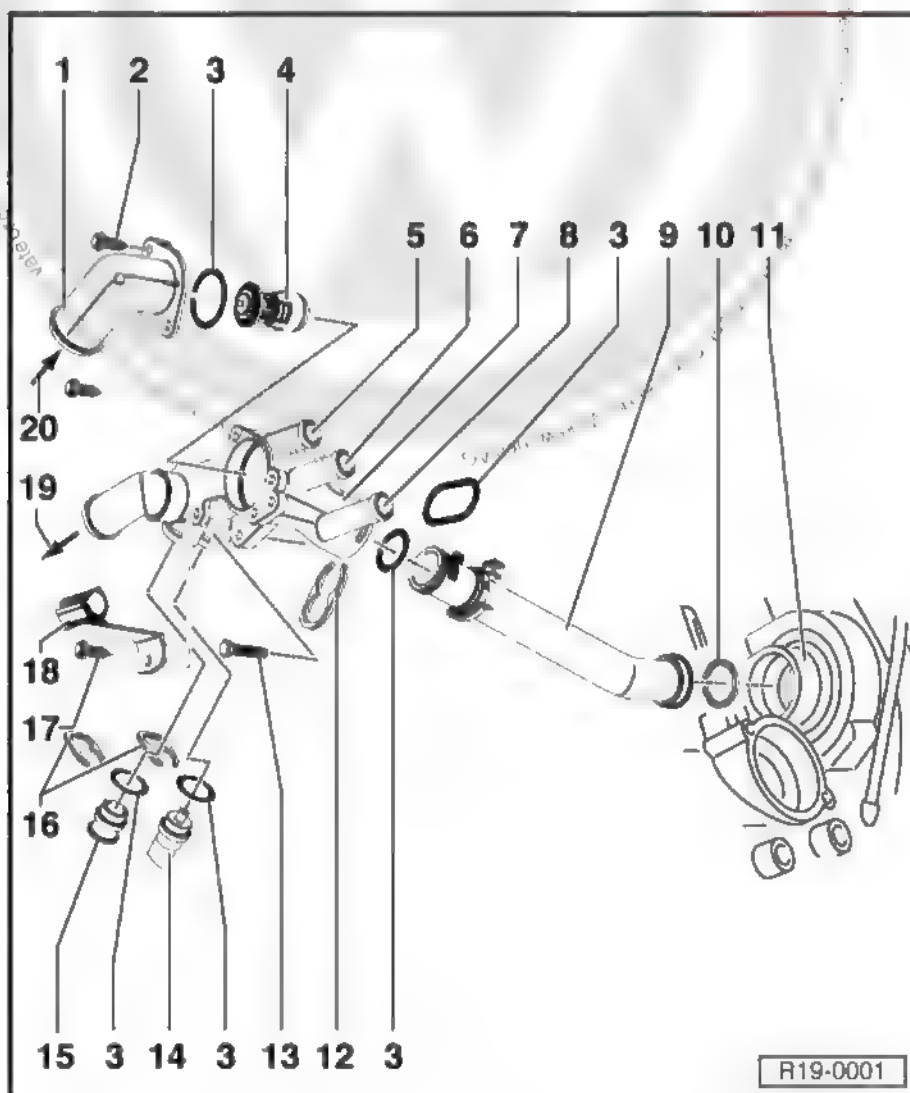
7 - Thermostatic valve housing

8 - From the heat exchanger

- ☐ Cooling system hose
connections diagram
→ [page 93](#) .

9 - Coolant pipe

- ☐ Cooling system hose
connections diagram
→ [page 93](#) .





10 - Seal ring

- ☐ Replace

11 - Water pump housing on the engine block

- ☐ Water pump remove and install ➔ [page 102](#)

12 - Clip

- ☐ Ensure proper fastening.

13 - 10 Nm

14 - Coolant temperature sender -G2-

- ☐ Not applicable to the BLH engine. Instead of Coolant temperature sender -G62- there is a plug, if it becomes necessary to release the system pressure.
- ☐ With Coolant temperature sender -G62- .
- ☐ To Engine control unit -J623- .
- ☐ If necessary, depressurize system before removal.

15 - Plug

- ☐ If necessary, depressurize system before removal.

16 - Clip

- ☐ Ensure proper fastening.

17 - 6 Nm

18 - Support

19 - For the radiator, below

- ☐ Cooling system hose connections diagram ➔ [page 93](#) .

20 - For radiator, on the top

- ☐ Cooling system hose connections diagram ➔ [page 93](#) .

1.2.1 Water pump side



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.



1 - Water pump

- ☐ Renew gasket, if damaged
- ☐ Check whether turn is smooth
- ☐ Remove and install
→ [page 102](#).

2 - Rear cover of the mechanical distribution

3 - Camshaft gear

- ☐ Observe fastening during installation.
- ☐ Observe the installation position of the tooth belt
→ [page 52](#).

4 - 20 Nm + 90°

- ☐ Renew each time after removing.
- ☐ To tighten and to loosen, lock the camshaft gear with Retainer -3036-.

5 - Toothed belt

- ☐ Mark rotation direction before removal.
- ☐ Check wear.
- ☐ Do not fold.
- ☐ Remove and install, adjust → [page 52](#).

6 - Upper cover of mechanical distribution system

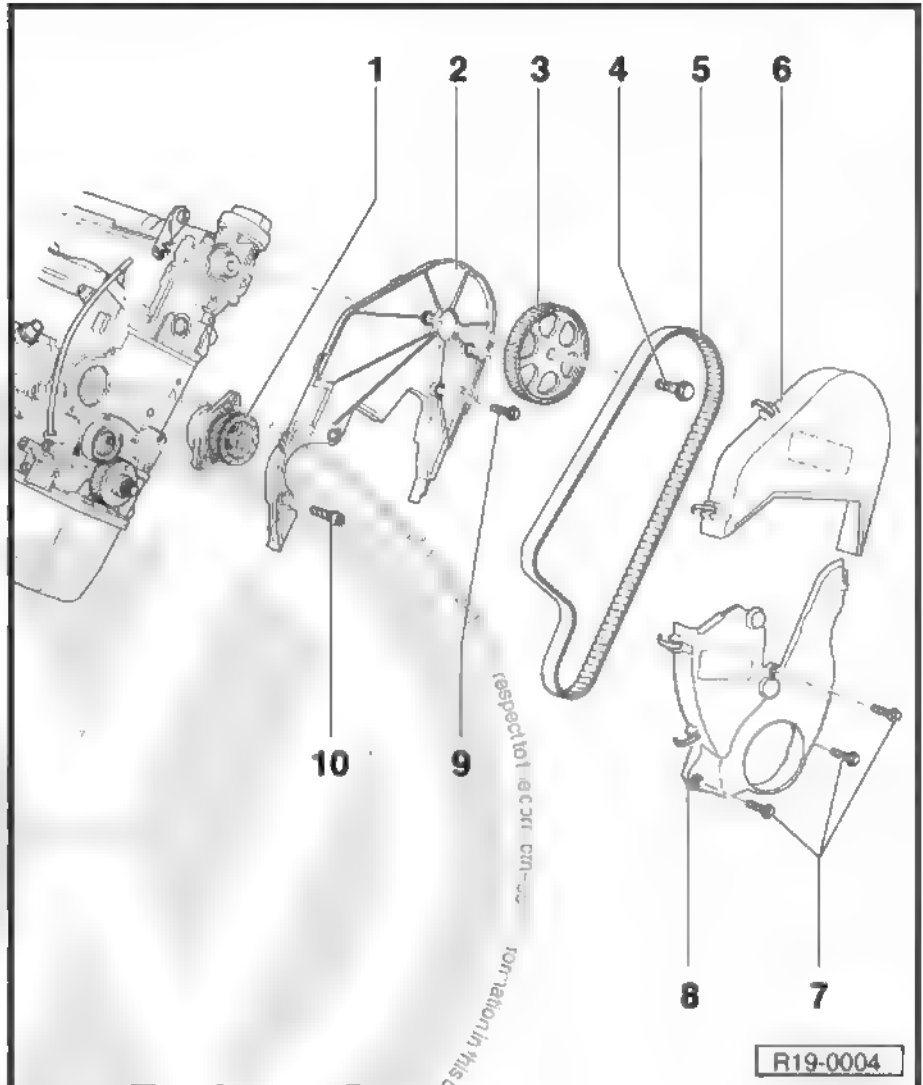
7 - 10 Nm

8 - Mechanical distribution lower cover

9 - 10 Nm

- ☐ Install with Adhesive -D 000 600 A2-.

10 - 20 Nm

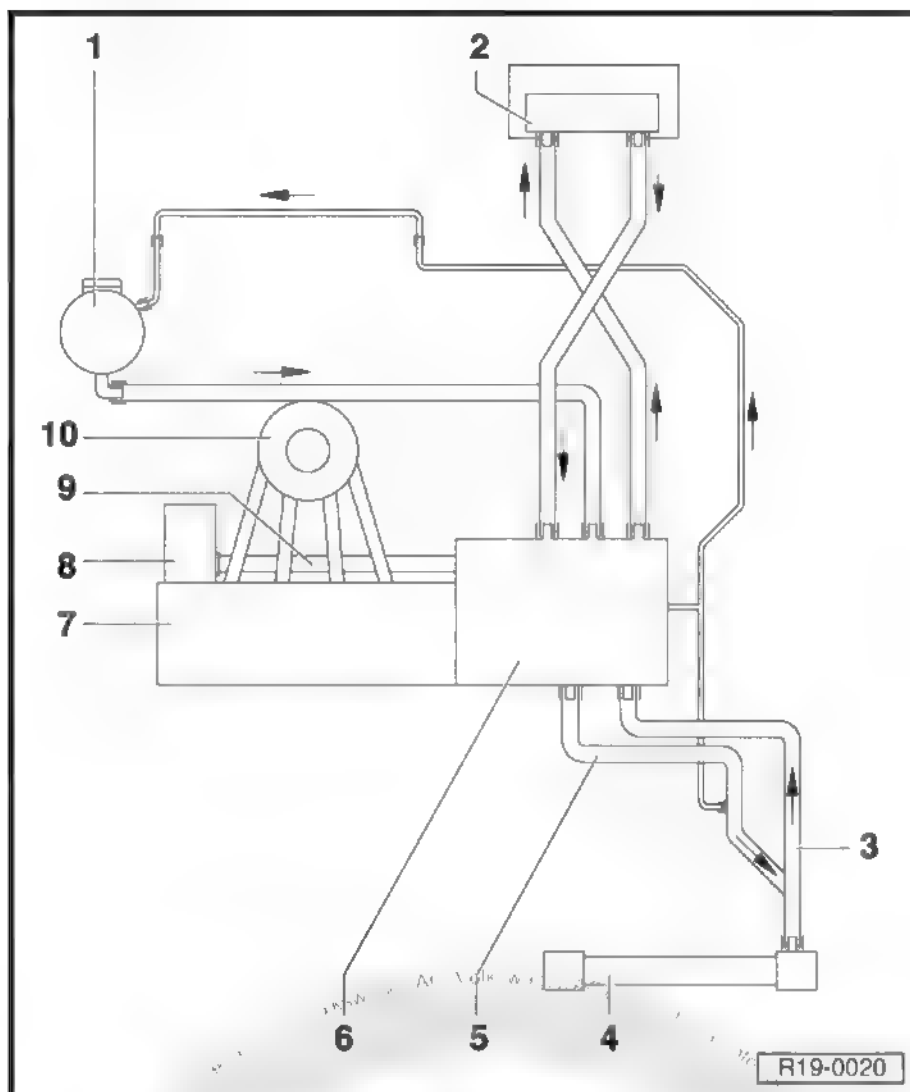


1.3 Cooling system hose connections diagram

Engines BAH, BJA, BPA and BLH



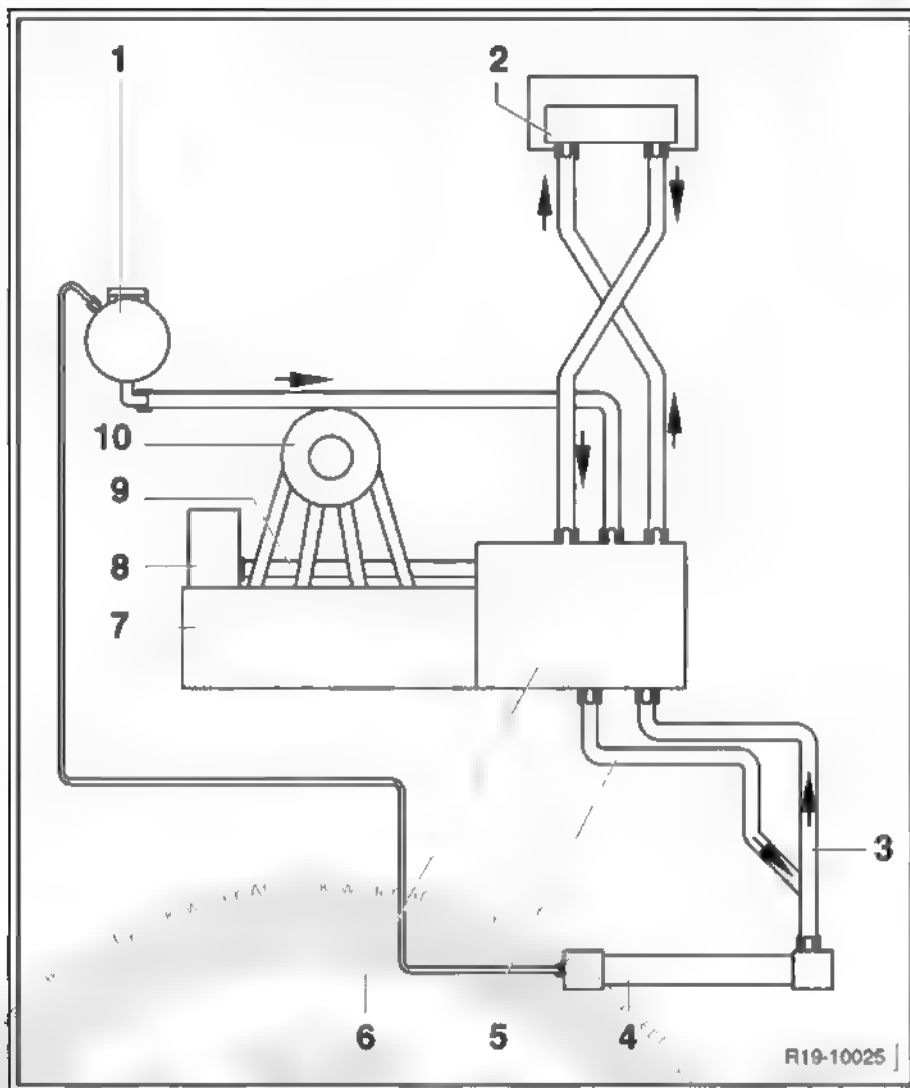
- 1 - ?Coolant container
- 2 - Heat exchanger
- 3 - Lower coolant hose
- 4 - Radiator
- 5 - Upper coolant hose
- 6 - Thermostatic valve housing
- 7 - Engine block/engine head
- 8 - Water pump
- 9 - Coolant pipe
- 10 - ?Intake manifold



Engines CCRA and CFZA



- 1 - ?Coolant container
- 2 - Heat exchanger
- 3 - Lower coolant hose
- 4 - Radiator
- 5 - Upper coolant hose
- 6 - Thermostatic valve housing
- 7 - Engine block/engine head
- 8 - Water pump
- 9 - Coolant pipe
- 10 - ?Intake manifold

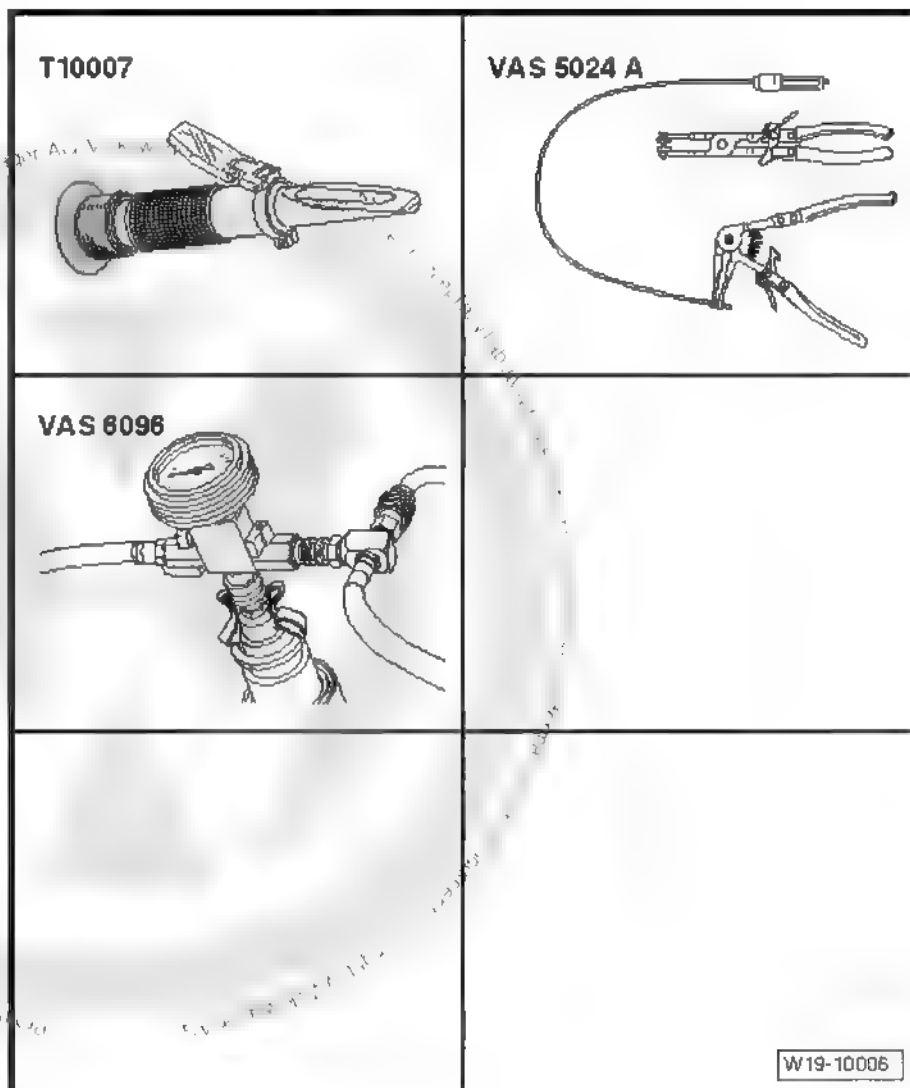




1.4 Cooling system - drain and fill

Special tools and workshop equipment required

- ◆ Refractometer for the analysis of the cooling system coolant or T 10007 -EQ 7093-
- ◆ Pliers for clamps of the Standard Type or VAS 5024A -VW 5162-
- ◆ Cooling system supply unit -VAS 6096-
- ◆ Cooling system tester - VAG 1274- or Cooling system tester -VAG 1274B-
- ◆ Adapter for VAG 1274 - VAG 1274/8-
- ◆ Oil sump -VAG 1306-



1.4.1 Drain



WARNING

Hot steam may escape while opening the coolant container, thus put a cloth over the cover to open it carefully.

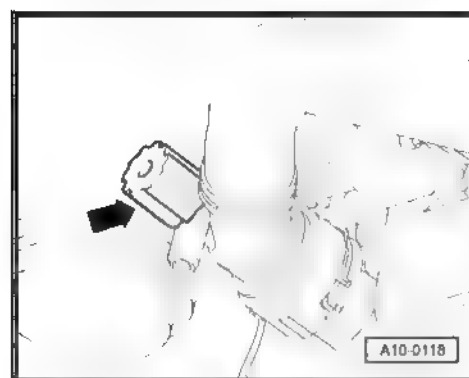
- Open the coolant container cover
- Remove lower engine compartment anti-noise



With draining device

- Open the radiator cooling system's draining device -arrow-

Without the draining device

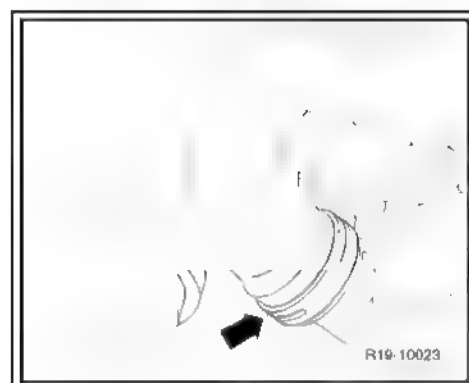


- Release the lower hose near the radiator (left side) -arrow-



Note

Observe cooling fluid disposal recommendations!





1.4.2 Fill



Note

- ◆ If possible, use the Coolant additive -G 012 A8G M1- G12, as per standard TL VW 774 F. It is identified by the red color.
- ◆ Under no circumstance mix Coolant additive -G 012 A8G M1- G12 with other antifreeze additives
- ◆ If the liquid in the container is brown, this means Coolant additive -G 012 A8G M1- G12 has mixed with another antifreeze additive. In this case, replace all of the antifreeze liquid
- ◆ The Coolant additive -G 012 A8G M1- G12 and antifreeze additives with the indication "in compliance with TL VW 774 F" avoid deterioration caused by corrosion, freezing or lime sedimentation, increasing the coolant boiling temperature even more. For these reasons, the cooling system must always contain prescribed mix of antifreeze and anti-corrosion products.
- ◆ Especially in tropical climate countries, the anti-freeze offers great help, due to its high boiling point, to ensure safety when the engine is submitted to intense operation.
- ◆ Anti-freeze protection shall be ensured to approximately -25 ° C (and approximately to -35 ° C in arctic climate countries).
- ◆ Coolant concentration shall not be reduced by adding water in hot seasons or hot countries. Anti-freeze additive percentage shall be of a minimum 40 %.
- ◆ If for weather reasons it is necessary to have greater anti-freeze protection, the percentage of Coolant additive -G 012 A8G M1- G12 can be increased, but only to 60% (antifreeze protection to up to -40°C). The higher the proportion the lower is the cooling capacity and anti-freeze protection.
- ◆ To determine antifreeze protection density, it is recommendable to use Refractometer for coolant analysis -EQ 7093 (VWB) - or - T 1000.
- ◆ Do not reuse used coolant in case the radiator, heat exchanger, head or head gasket have to be replaced.

Recommended mixture ratios:

Anti-freeze protection until	Anti-freeze proportion	G 12 ¹³⁾	Water ¹³⁾
-25 °C	40 %	2.25 l	3.35 l
-35 °C	50 %	2.8 l	2.8 l

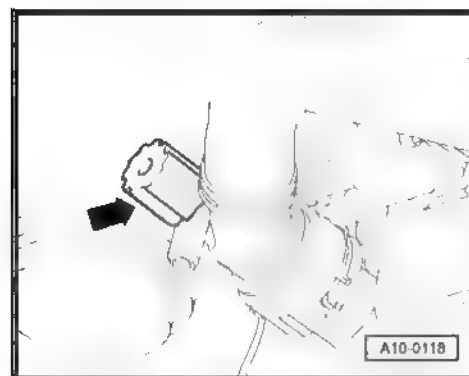
13) The quantity of coolant may vary according to each vehicle equipment.



With draining device

- Close the cooling system's drainage device-arrow-

Without the draining device

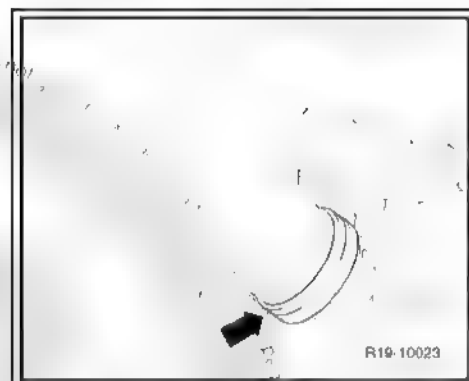


- Attach the lower hose near the radiator (left side) arrow-
- Install lower engine compartment noise insulator.

With Cooling system supply unit -VAS 6096-

- Fill cooling system with Cooling system supply unit -VAS 6096- ⇒ Operating instructions for the Cooling system supply unit -VAS 6096-

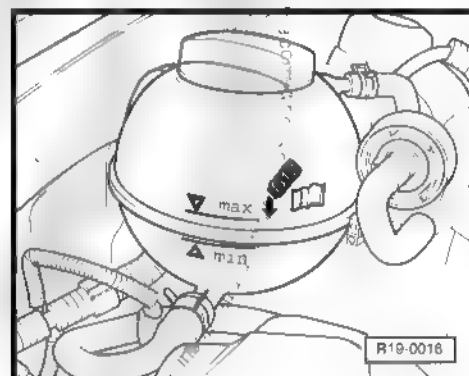
Without Cooling system supply unit -VAS 6096-



- Refill with coolant up to the max. mark on the coolant container.

With and without Cooling system supply unit -VAS 6096-

- Close the coolant container.
- Start engine and keep 2000 rpm rotation for approximately 3 minutes.
- Allow the engine to run until Radiator fan -V7- turns on.



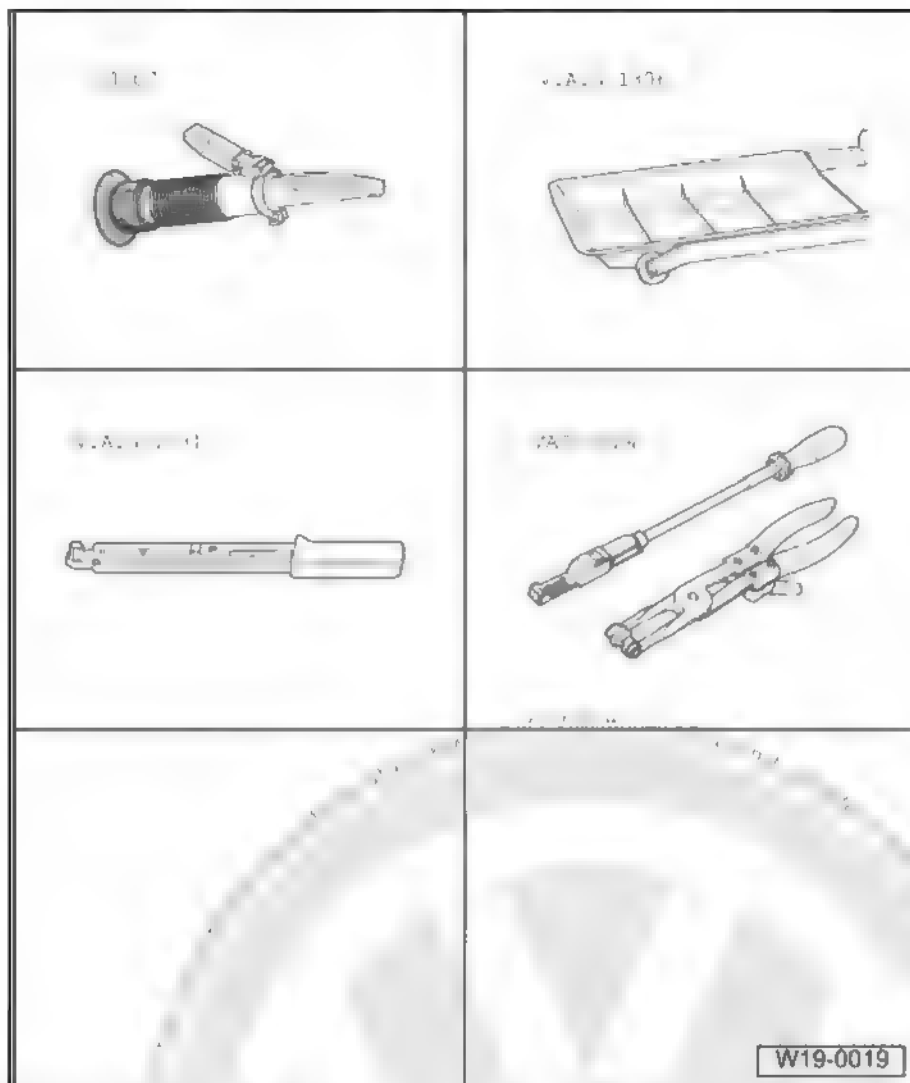
WARNING

Hot steam may escape while opening the coolant container, thus put a cloth over the cover to open it carefully.

- Check coolant level and add fluid as necessary: With engine heated, coolant level must reach upper mark of graded field. With engine cold, coolant level must be on the center of graded field.



1.5 Radiator - remove and install



Special tools and workshop equipment required

- ◆ Refractometer for coolant analysis -EQ 7093- or Refractometer for coolant analysis -T 10007-
- ◆ Oil sump -VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Standard-type clamp pliers -VW 5162- or Standard-type clamp pliers -VAS 5024A- or the Hose clamping pliers -VAG 1921-

1.5.1 Removal

- Remove bumper cover ⇒ Body - external mountings; Rep. Gr. 63 ; Bumpers .
- Removing the front panel ⇒ Body - external mountings; Rep. Gr. 50 ; Body - Front part .
- Drain the cooling system ➔ [page 96](#) .
- Disconnect rapid coolant hose connections at the radiator.
- Unplug the connector of the Radiator fan -V7- .



- Remove the radiator fixing screws and remove the radiator with the Radiator fan.
- Follow additional assembly instructions → [page 101](#).

1.5.2 Installation

Installation happens in removal reversed order, considering the following:

- Supply cooling system ⇒ [page 96](#).
- Remove front panel ⇒ Body - external mountings; Rep. Gr. 50 ; Body - Front part.
- Install bumper cover ⇒ Body - external mountings; Rep. Gr. 63 ; bumpers.

1.5.3 Further indications



WARNING

Do not open the air conditioning refrigerant gas circuit.



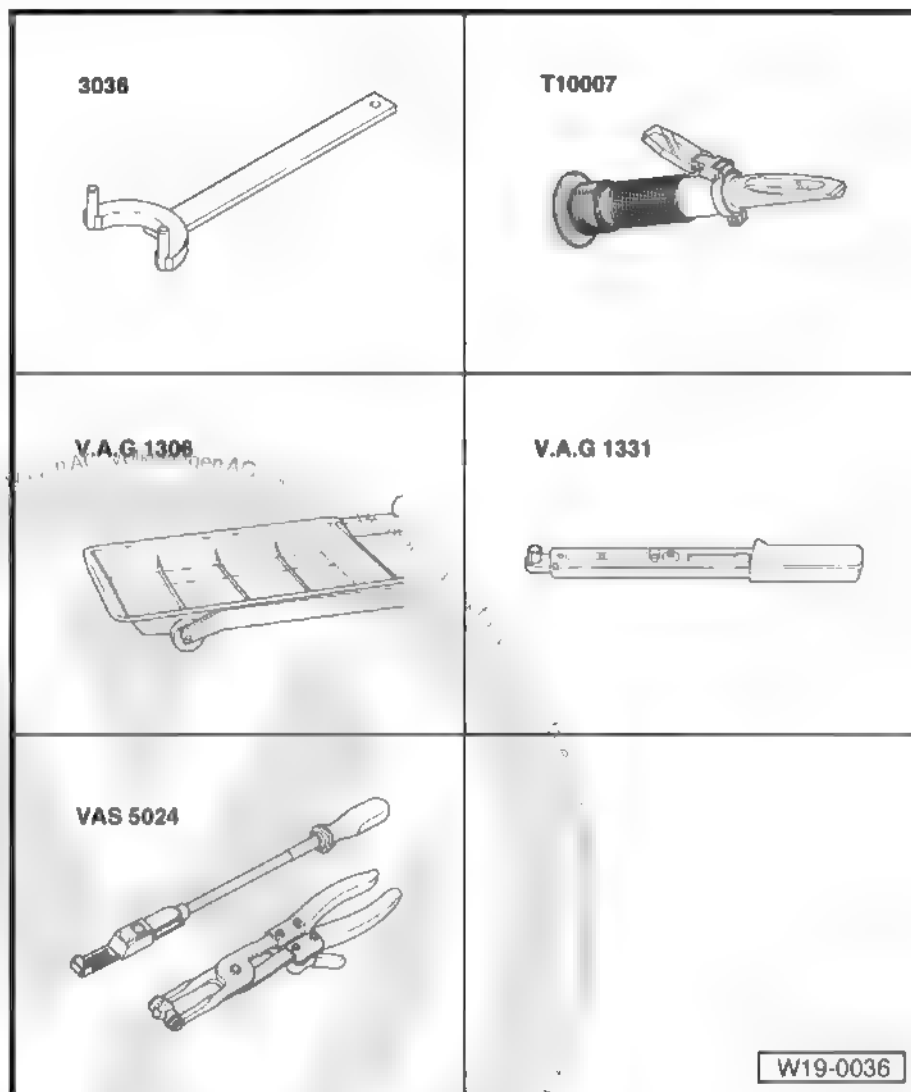
Note

In order to avoid damages to the condenser and cooling gas tubes/hoses, ensure they are not twisted, folded or excessively stretched.

- Loosen the retaining clamp(s) of refrigerant gas hoses.
- Loosen the radiator condenser and support it.



1.6 Water pump - remove and install



Special tools and workshop equipment required

- ◆ Retainer -3036-
- ◆ Refractometer for coolant analysis -EQ 7093- or Refractometer for coolant analysis -T 10007-
- ◆ Oil sump -VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Standard-type clamp pliers -VW 5162- or Standard-type clamp pliers -VAS 5024A- or the Hose clamping pliers -VAG 1921-



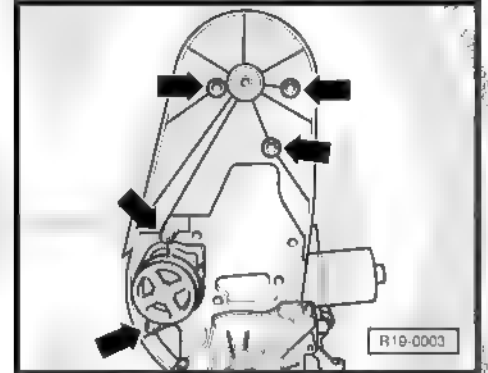
Note

- ◆ *The built-in seal of the water pump shall be separated from the pump.*
- ◆ *In case of faults and leakage, replace the complete pump along with the seal*



1.6.1 Removal

- Drain the cooling system ➔ [page 96](#) .
- Remove toothed belt ➔ [page 52](#) .
- Remove camshaft sprocket. To loosen the screw, lock the camshaft gear with the Wrench -3036-
- Loosen the fastening screws -arrows- of the back mechanical distribution cover and of the water pump.
- Remove the water pump along with the rear engine block cover of the mechanical distribution.



1.6.2 Installation

Install by inverting the removal sequence, paying attention to the following:

- Install the water pump with the rear mechanic distribution cover and tighten the lower fixing screws. Tightening torque: 20 Nm.
- Tighten the three upper fixing screws of the rear mechanic distribution cover. Tightening torque: 10 Nm (install with Adhesive -D 000 600 A2-).
- Install the camshaft gear and tighten the new screw (use Retainer -3036-) . Tightening torque: 20 Nm + 90°.

How to install the toothed belt and to set the camshaft timing
⇒ [page 52](#) .

Supply cooling system ⇒ [page 96](#) .



20 – Fuel supply system

1 Fuel supply system components - remove and install



Note

- ◆ *Hose connections are fixed with either spring and quick coupling clamps (pop top), for the latter, although, it is necessary to replace the lock whenever it is disconnected.*
- ◆ *Only use spring clamps to fix the fuel hoses on the engine; clamp or screws are not allowed.*
- ◆ *To install the spring clamps, it is recommended you use Standard-type clamp pliers -VW 5162- or Standard-type clamp pliers -VAS 5024A- or the Hose clamping pliers -VAG 1921-.*

Follow the safety measures ⇒ [page 106](#) .

Respect cleaning rules ⇒ [page 107](#) .

Remove and install the fuel tank ⇒ [page 117](#) .

Fuel tank components with accessories and fuel filter - remove and install ⇒ [page 105](#) .

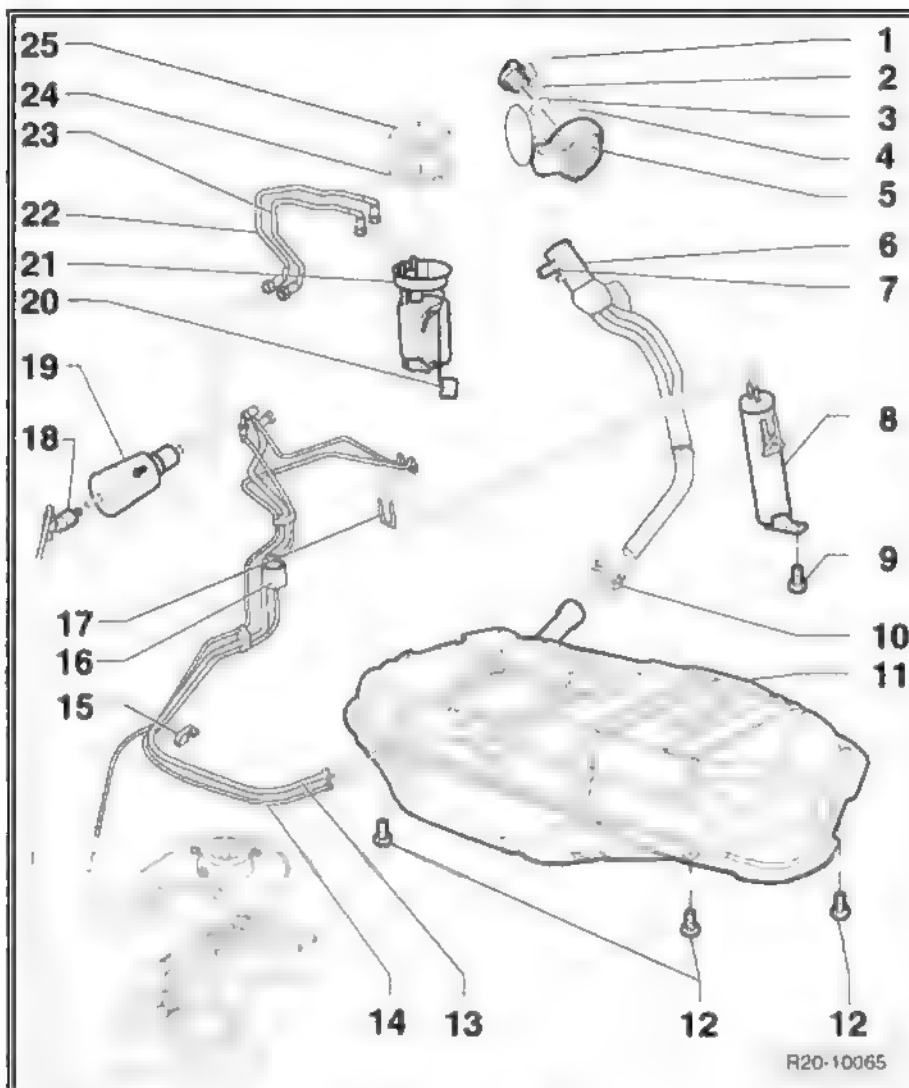
Repair components of the electronic engine power adjustment (electronic accelerator) ⇒ [page 127](#) .

Repair the activated coal filter system components ⇒ [page 130](#) .



1.1 Fuel tank components with accessories and fuel filter - remove and install

- 1 - Fixing clip
- 2 - Reservoir lid
- 3 - Seal ring
 - ☐ Replace if damaged
- 4 - Fixing screw
- 5 - Fuel tank cover
 - ☐ With rubber cauls.
 - ☐ Remove and install ⇒ Body - external mountings; Rep. Gr. 55 ; Covers .
- 6 - Fuel supply tube
- 7 - Ventilation valve
 - ☐ ⇒ [page 106](#)
- 8 - Activated charcoal filter
 - ☐ Installation location: on right rear wheel box.
- 9 - 10 Nm
- 10 - Spring clamp
- 11 - Fuel tank
 - ☐ Remove using Gearbox jack or engine + gearbox assembly jack or VAG 1383A-EQ 7081-.
 - ☐ Remove and install ⇒ [page 117](#) .
- 12 - 26 Nm
- 13 - Tank hose up to the activated charcoal filter
- 14 - Tank hose up to the gravity valve
- 15 - Bearing
- 16 - Gravity valve
 - ☐ For removal remove the right rear wheelhouse cover.
 - ☐ Check valve flow continuity. Perpendicular valve: open. Valve tilted 45°: closed.
- 17 - Union
- 18 - Rapid coupling
- 19 - Fuel filter
 - ☐ Installation position: arrow indicates flow direction.
- 20 - Fuel gauge sender -G-
 - ☐ Remove and install ⇒ [page 116](#) .
- 21 - Fuel system pressurization pump -G6-
 - ☐ Remove and install ⇒ [page 114](#) .
 - ☐ On pump removal renew the sealing ring.
 - ☐ Clean filter if dirty.
 - ☐ Check Fuel system pressurization pump -G6- ⇒ [page 120](#) .
 - ☐ Observe the installation position on the fuel tank ⇒ [page 106](#)





22 - Feed tubing

- ☐ Black.
- ☐ Ensure proper fastening
- ☐ Of fuel distributor

23 - Return piping

- ☐ Blue
- ☐ Fastened to the side of fuel container.
- ☐ Ensure proper fastening

24 - Thrust ring

25 - ?Lock ring

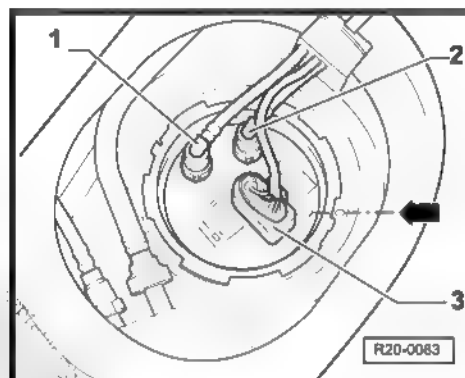
Installation position for Fuel system pressurization pump -G6-

The arrow on Fuel system pressurization pump -G6- must be aligned with the yellow mark on the right side of the body -arrow-.

Blue return tubing -1- on the connection.

Black supply tubing -2- on the connection.

Electrical connector for Fuel system pressurization pump -G6- -3-.



Note

After the installation of Fuel system pressurization pump -G6- check whether the supply and return hoses are still attached to the fuel tank.

Check the ventilation valve

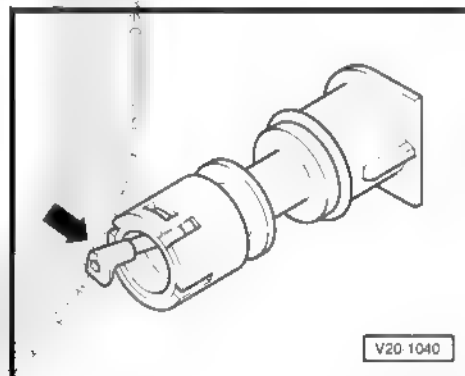
Lever in resting position: closed.

Lever pressed towards the -arrow-: open.



Note

Before the installation of the ventilation valve, remove the fuel tank cover.



1.2 Safety measures for work on the fuel supply



WARNING

During assembly work, especially on the engine compartment, take the following into account due to lack of space:

- ◆ All hoses (e.g. fuel, hydraulic, activated charcoal filter system, coolant and refrigerant gas, brake fluid, vacuum) and electric cables must be arranged in a way to return to their original positions.
- ◆ Ensure easy access to all mobile parts or that may be hot.



When removing or installing Fuel gauge sender -G- or Fuel system pressurization pump -G6-, when the fuel tank is full or partially full, observe:



WARNING

The fuel supply hose is under pressure. Prior to loosening the hose junctions, place a cloth around them. Then eliminate the pressure by carefully removing the hose.

- ◆ Before starting jobs it is necessary to have, near the installation area of fuel container, the sucking hose of an extracting equipment (exhauster) in operation, to absorb gases released by the fuel. If an exhauster is not available, use a radial fan (engine out of air flow) with air moving rate higher than 15 m³/ hour.
- ◆ Avoid contact of fuel with the skin! Use fuel protection gloves!
- ◆ Prior to opening the system, remove the fuse number for safety reasons. 33 feed of Fuel system pressurization pump -G6-.

1.3 Rules for cleanliness

For jobs on the fuel and injection system, strictly observe the following "5 cleaning" rules:

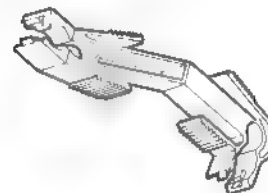
- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Place the removed parts on a clean surface and cover them. Do not use cloths with lints!
- ◆ If repair work is not immediately carried out, open components shall be covered and carefully reserved.
- ◆ Only install clean components. Remove the spare parts from their packaging just before installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With open system: whenever possible, avoid the use of compressed air. If possible, do not move the vehicle.

1.4 Quick connection "Pop Top" - Disconnect and connect

Special tools and workshop equipment required

- ◆ Wrench -VW 049-

VW 049



Q00-0061

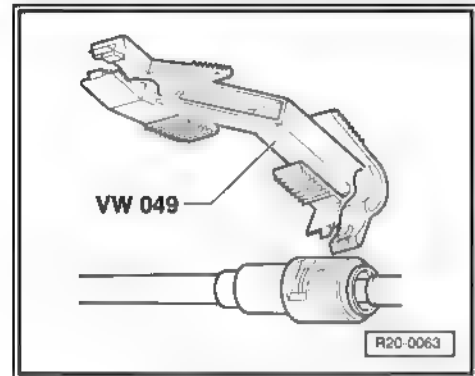


WARNING

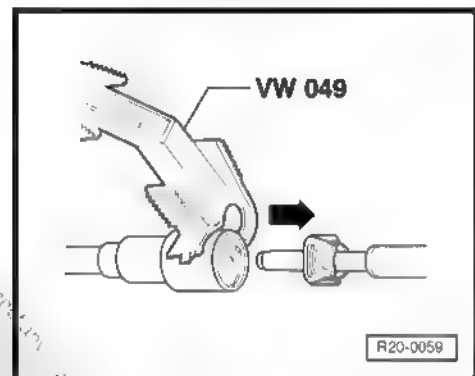
Fuel in the supply line is under pressure, therefore, depressurize the system prior to disconnecting the hoses.

1.4.1 Disconnecting

- Place the Wrench -VW 049- on the connector.



- Pull the tube from the connection body to disconnect it -arrow-.

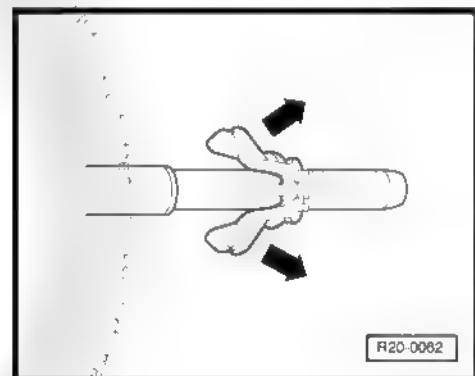


- In order to remove the lock, move it in the direction of the -arrows-.



Note

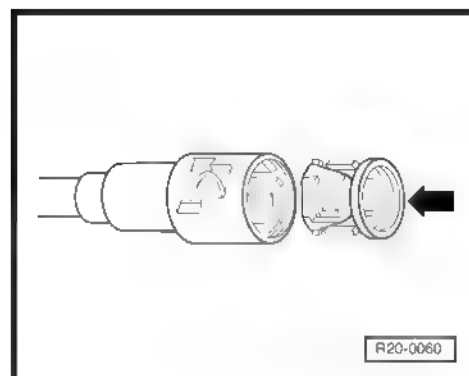
Whenever undoing a quick coupling, lock must always be renewed.





1.4.2 Connect

- Using a new lock, install it on the connector -arrow-.

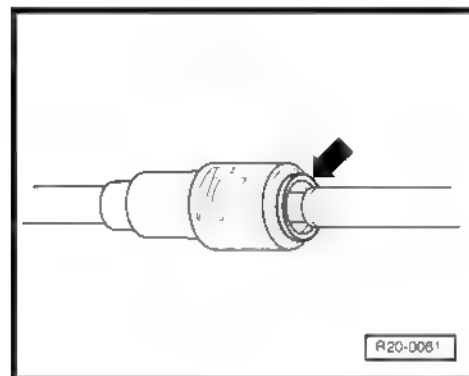


- Reconnect. The ring for the proper verification of the assembly is released -arrow- from the lock when pulling on the connector in the disconnection direction.



Note

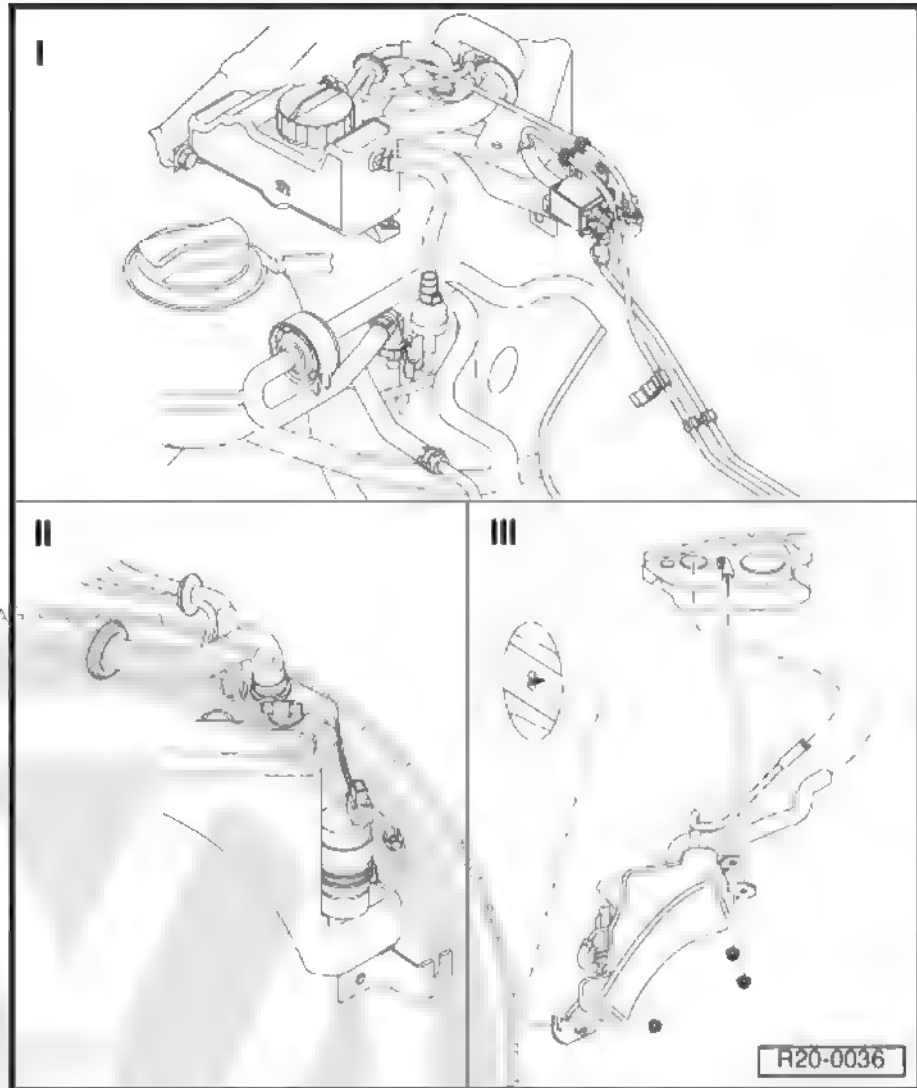
Ensure the quick coupling is fully engaged (install it until hearing "a typical" click).



1.5 Fuel pump for cold start -V263- - Remove and install

BJA and BPA





Note

- ◆ Always keep the gasoline tank filled whichever the season.
- ◆ The cold start system works with room temperature lower or equal to 15 °C.

I ⇒ [page 110](#)

II ⇒ [page 111](#)

III ⇒ [page 112](#)

1.5.1 Part I

Engine compartment.



1 - Gasoline supply tank

2 - Hose

- ☐ for gasoline tank ventilation.
- ☐ Hose fastening with deformable clamp
- ☐ Replace the clamp and install with Hose clamp pliers -VW 004V- or Hose clamp pliers -VAG 1275-.

3 - Hose

- ☐ for fuel tank supply.

4 - Gasoline tank of the cold start system

- ☐ For removal, remove the right front wheel and the wheel box protector
⇒ Body - external mountings; Rep. Gr. 66 ; External equipment.

5 - Feed tubing

- ☐ To Cold start valve - N17-.

6 - Ventilation tubing

- ☐ To the air cleaner.

7 - Feed tubing

- ☐ For Throttle valve module -J338-.

8 - Cold start valve -N17-

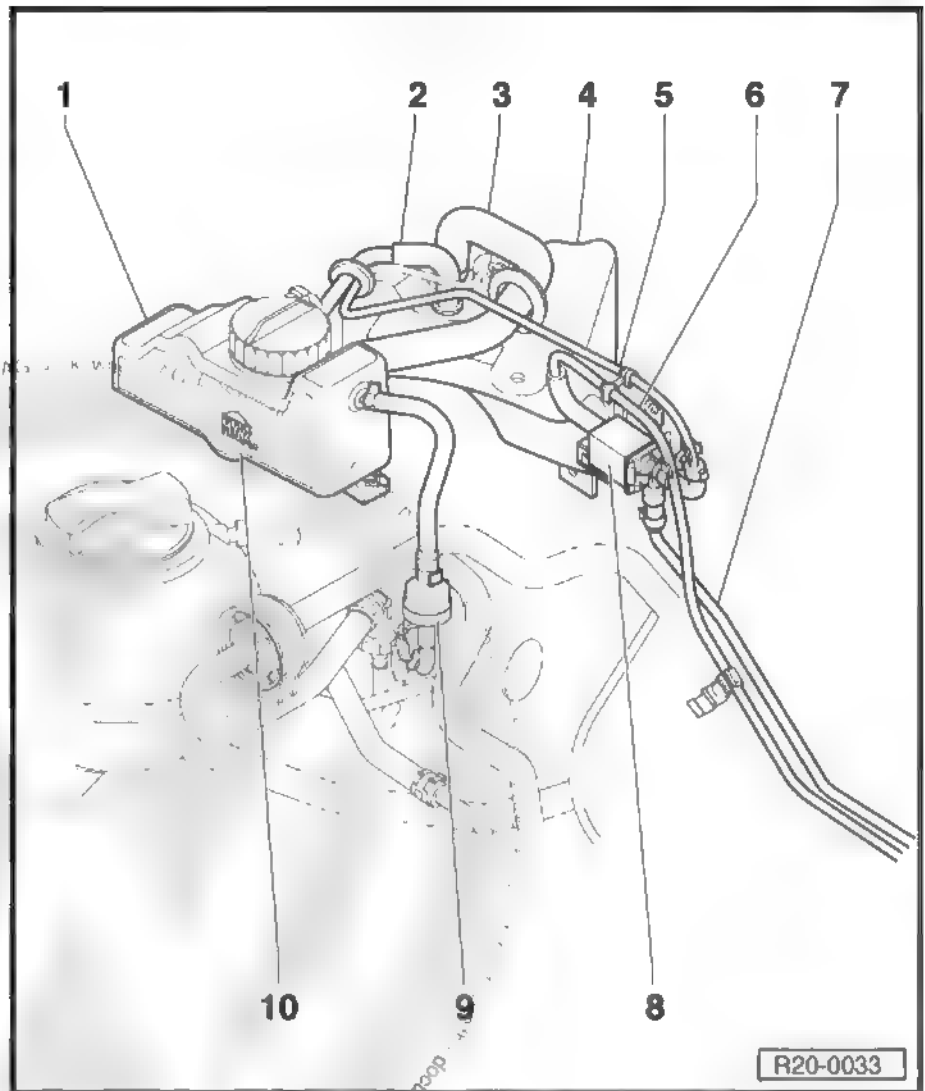
- ☐ 2-way.

9 - Ventilation valve

- ☐ Unidirectional.
- ☐ For activated charcoal filter.
- ☐ Blue tubing.

10 - Max. supply mark

- ☐ Do not exceed the maximum limit indicated.



1.5.2 Part II

Right front wheelhouse.



1 - Eyelet

- ☐ Use neutral soap to facilitate installation

2 - Hose

- ☐ for fuel tank ventilation
- ☐ Hose fastening with deformable clamp
- ☐ Replace the clamp and install with Hose clamp pliers -VW 004V- or Hose clamp pliers -VAG 1275-.

3 - Hose

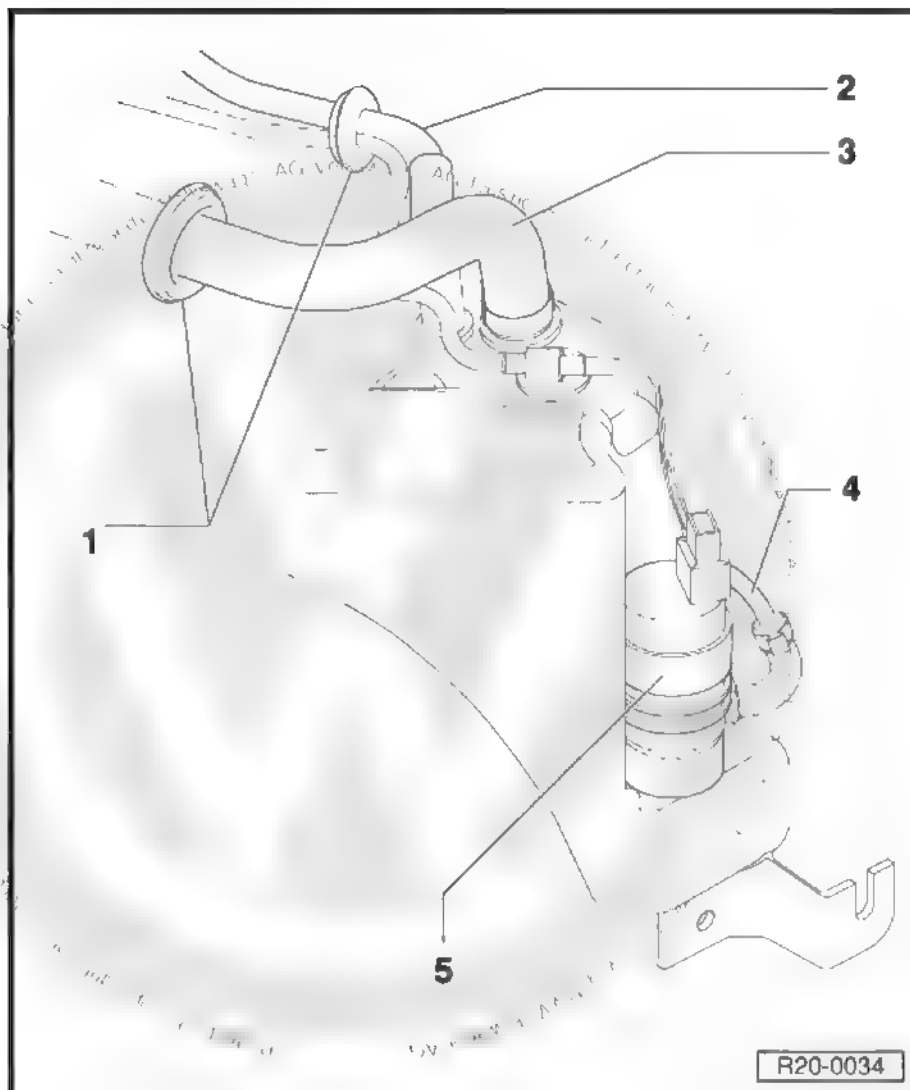
- ☐ for fuel tank supply.

4 - ?Piping

- ☐ For supply.
- ☐ Of Fuel pump for cold start -V263- to Cold start valve -N17-.

5 - Fuel pump for cold start - V263-

- ☐ For removal, disengage from the reservoir.



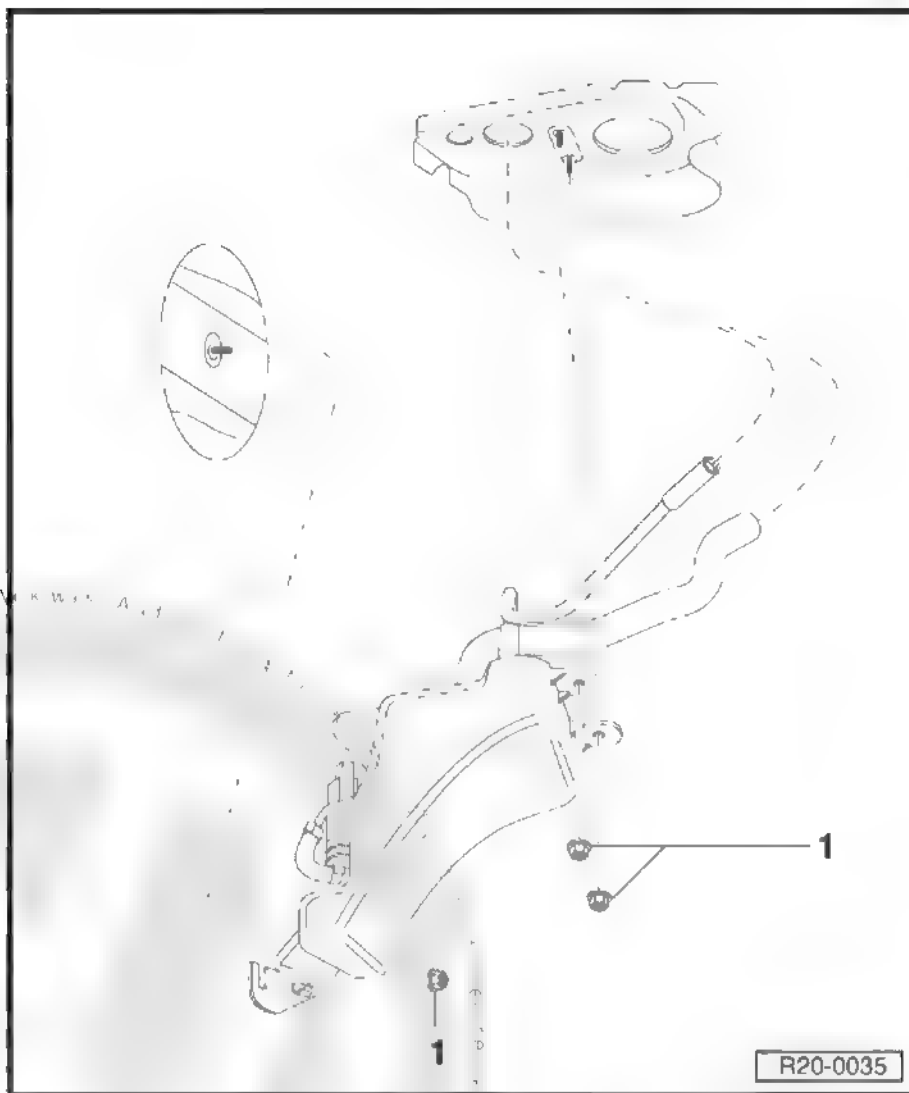
1.5.3 Part III

Right front wheelhouse (mounting of the gasoline tank).

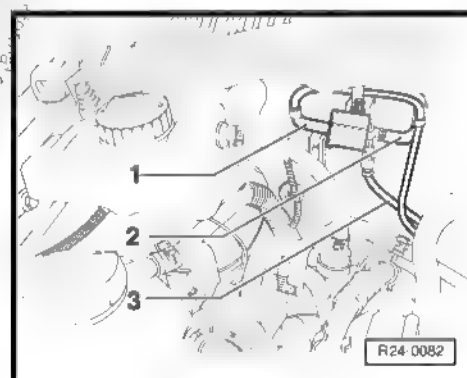


1 - 8.0 Nm

- When installing the tank, the hoses and Fuel pump for cold start - V263- must be installed



- Hose position on Cold start valve -N17- . -1- Ventilation hose
- 2- Hose of Fuel pump for cold start -V263- at the fuel tank
- 3- Hose of Cold start valve -N17- to the intake manifold.



1.5.4 Cold start system components - remove and install

CCRA Engine



1 - Gasoline tank

2 - Hose

- ☐ for aeration
- ☐ Hose fastening with de-
formable clamp
- ☐ Replace the clamp and
install with Pliers for
clamps or VAG 1275 -
VW 004V-

3 - Supply hose

- ☐ Of Fuel pump for cold start -V263- to Cold start
valve -N17- .
- ☐ Hose fastening with de-
formable clamp.
- ☐ Replace the clamp and
install with Pliers for
clamps or VAG 1275 -
VW 004V- .

**4 - Fuel pump for cold start -
V263-**

- ☐ For removal, disengage
from the reservoir.

5 - Cold start valve -N17-

- ☐ 3-way.

6 - Hose

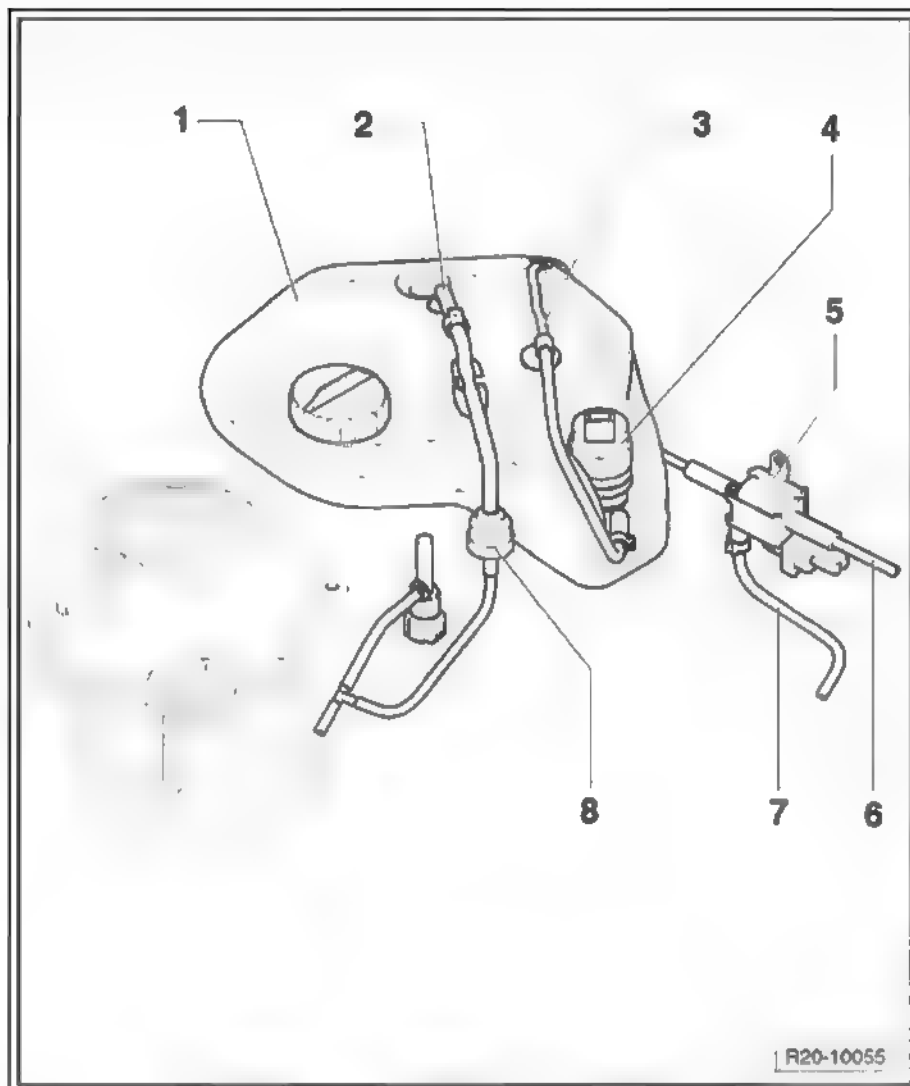
- ☐ Aeration to the air filter.
- ☐ Hose fastening with de-
formable clamp.
- ☐ Replace the clamp and
install with Pliers for
clamps or VAG 1275 -
VW 004V- .

7 - Hose

- ☐ Supply to the Throttle valve module -J338- .
- ☐ Hose fastening with deformable clamp.
- ☐ Replace the clamp and install with Hose clamp pliers -VW 004V- or Hose clamp pliers -VAG 1275- .

8 - Ventilation valve

- ☐ Unidirectional.
- ☐ For activated charcoal filter.
- ☐ Blue tubing.



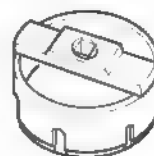
1.6 Fuel system pressurization pump -G6- - Remove and install

Special tools and workshop equipment required



- ◆ Wrench or T 10334 -VW 5321/9-

VW 5321/9



Q00-0018

- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-

V.A.G 1332



W00-0428

1.6.1 Removal

- Before you begin removal jobs, take safety precautions [⇒ page 106](#) .
- Respect cleaning rules [⇒ page 107](#) .
- Check whether the vehicle has a coded radio. If this is the case, request the anti-theft code.
- With the ignition switched off, disconnect the ground cable from Battery -A- .
- Fold the rear seat frontwards.
- Remove the access lid to Fuel system pressurization pump -G6- .



WARNING

The fuel supply hose is under pressure. Prior to loosening the hose junctions, place a cloth around them. Then eliminate the pressure by carefully removing the hose.

- Remove return tubing -1-, for supply -2- and the connector -3- from the Fuel system pressurization pump -G6- .

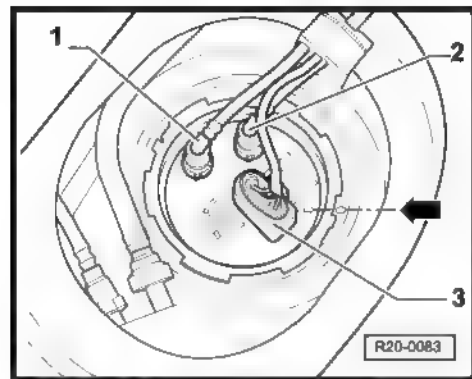


A -arrow- indicates the installation position of the Fuel system pressurization pump -G6- .



Note

To remove fuel hoses, press safety button below connection.

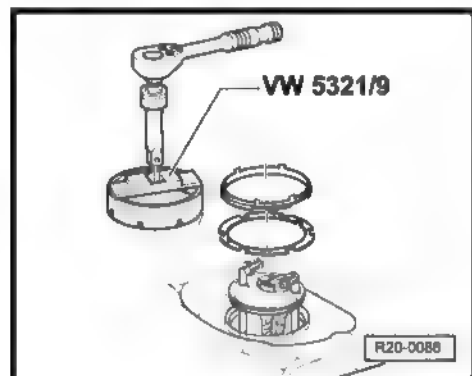


- Remove the lock with Wrench or T 10334 -VW 5321/9- .
- Remove the Fuel system pressurization pump -G6- and the seal for the opening in the fuel tank.



Note

If Fuel system pressurization pump -G6- is being replaced, empty the old Fuel system pressurization pump -G6- before discarding.



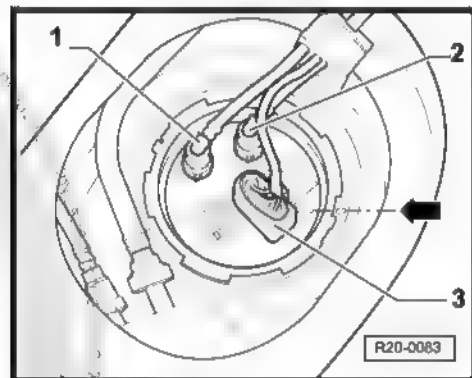
1.6.2 Installation

- Installation of the Fuel system pressurization pump -G6- must be performed in reverse order of removal.



Note

- ◆ Do not fold the Fuel gauge sender -G- during installation.
- ◆ Install the new sealing ring for the Fuel system pressurization pump -G6- dry on the fuel tank opening.
- ◆ Lubricate the new sealing ring with fuel to install the Fuel system pressurization pump -G6- .
- ◆ Observe the installation position for the Fuel system pressurization pump -G6- -arrow-. The mark on Fuel system pressurization pump -G6- must match the mark on the body.
- ◆ Check the correct seating of the fuel hoses.
- ◆ Do not confound supply and return hoses.
- ◆ After the installation of Fuel system pressurization pump -G6-, check whether the intake, return, and ventilation hoses are still attached to the fuel tank



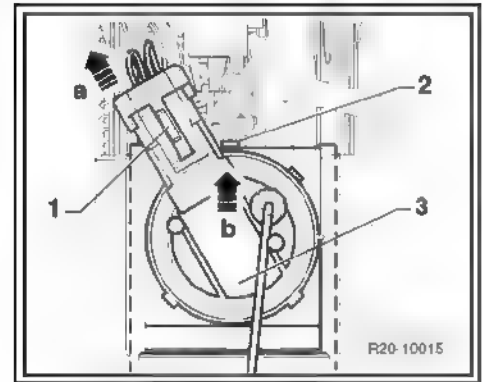
1.7 Fuel level sensor -G- - Remove and install

1.7.1 Removal

- Remove the Fuel system pressurization pump -G6-
→ [page 114](#) .
- Disconnect the connector of the Fuel gauge sender -G- moving lock -1- and moving it towards the arrow direction -nd-.



- Press the lock-2- and move Fuel gauge sender -G- -3- upwards in the direction of the arrow -b-



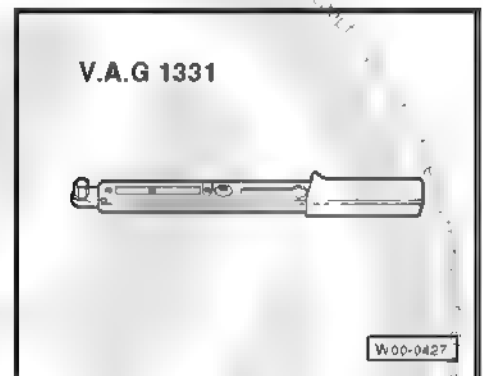
1.7.2 Installation

- Position the Fuel gauge sender -G- on the guides of Fuel system pressurization pump -G6- and press downwards until it fits in.
- Install the connector of Fuel gauge sender -G- .

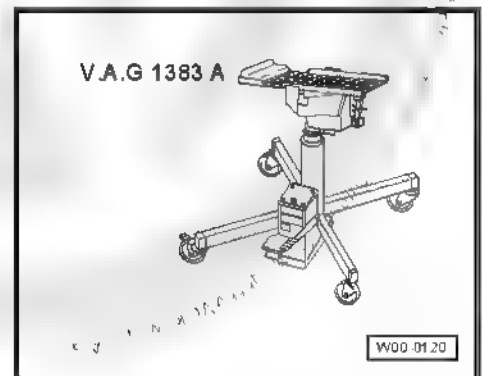
1.8 Fuel tank - remove and install

Special tools and workshop equipment required

- ◆ Torque wrench - 5 to 50 Nm (socket 1 1/2") -VAG 1331-

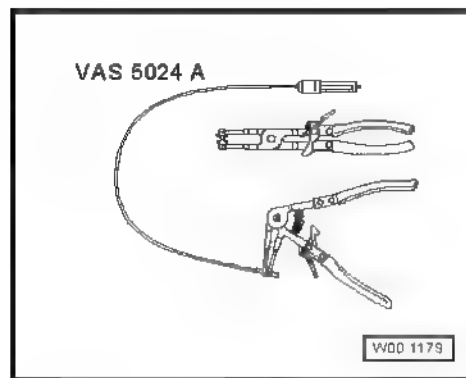


- ◆ ?Engine-/gearbox jack -EQ 7081- or ?Engine-/gearbox jack - VAG 1383A-





- ◆ Pliers for clamps of the Standard Type or VAS 5024A -VW 5162- or Pliers -VAG 1921-



1.8.1 Removal

Prerequisites:

- The fuel tank shall only be filled up to half level.



Note

- ◆ *Drain fuel tank with Fuel suction and storage device -VAS 5190- .*
- ◆ *Before you begin removal jobs, take safety precautions ⇒ [page 306](#) .*
- Check whether the vehicle has a coded radio. If this is the case, request the anti-theft code.
- With the ignition switched off, disconnect the ground cable from Battery -A- .
- Remove the tank cover.
- Drain the fuel tank and clean the surroundings of the fill nozzle.
- Fold the rear seat frontwards.
- Remove the access lid to Fuel system pressurization pump - G6- .
- Disconnect the 4-pole connector from Fuel system pressurization pump -G6- .
- Remove fuel tank hoses.
- Loosen exhaust system. Exhaust system must be secured with metal wire to the body, slightly lowered.
- Remove the heat deflector between the exhaust and the fuel tank.

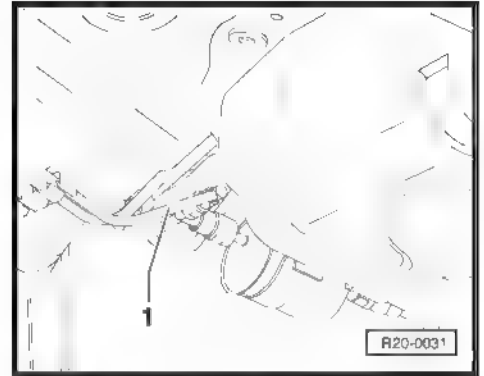


- Release supply hose -1- to the filter
- Remove the supply tube clamp near the container with Pliers for clamps of the Standard Type or VAS 5024A -VW 5162- or Pliers -VAG 1921- .
- Remove the securing screws, propping the fuel tank with ? Engine-/gearbox jack -EQ 7081- or ?Engine-/gearbox jack - VAG 1383A- .
- Lower the fuel tank



WARNING

The fuel supply hose is under pressure. Prior to loosening the hose junctions, place a cloth around them. Then eliminate the pressure by carefully removing the hose.



1.8.2 Installation

Install in removal reversed order, considering the following:

- ◆ Install the ventilation and fuel hoses without bending them.
- ◆ Check the correct seating of the fuel hoses.

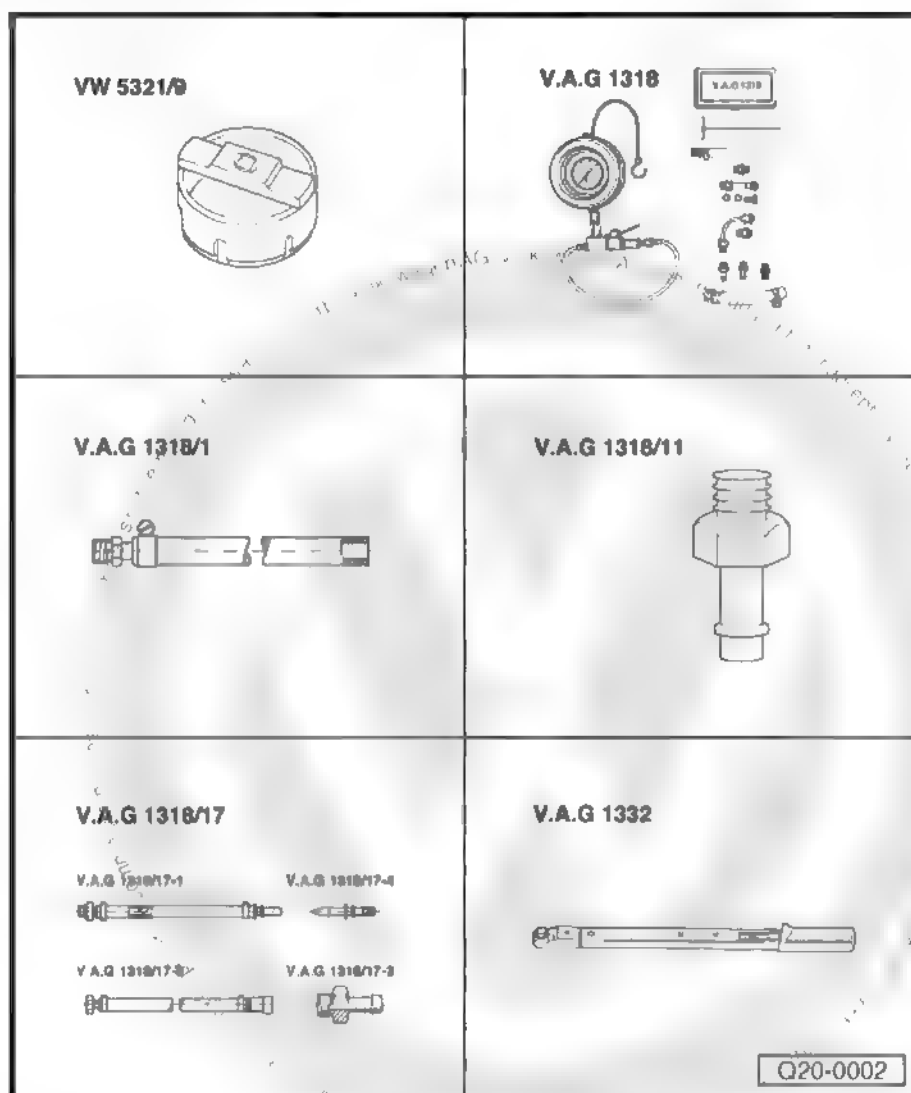


Note

Once the fuel tank is installed, check if the supply, return and ventilation hoses are still fixed.

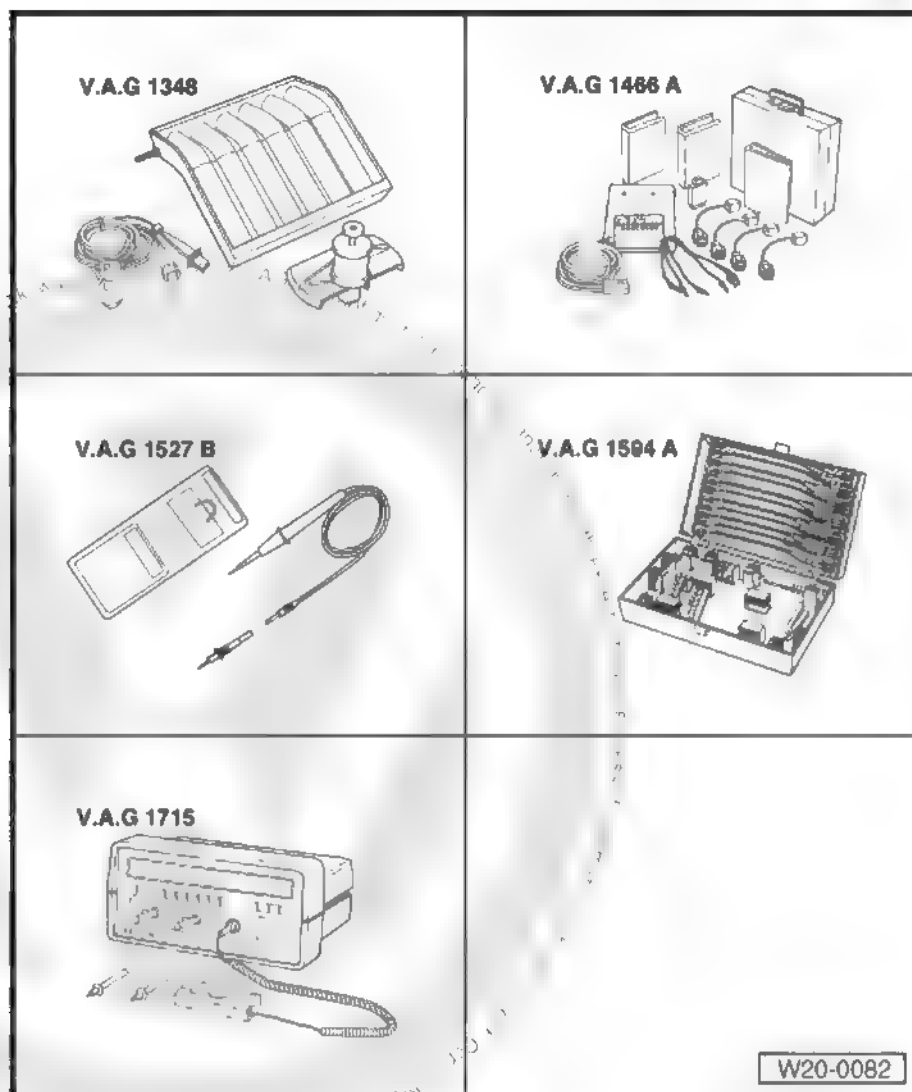


1.9 Fuel system pressurization pump -G6- - Check



Special tools and workshop equipment required

- ◆ Wrench or T 10334 -VW 5321/9-
- ◆ Pressure tester -VAG 1318-
- ◆ Adapter -VAG 1318/1-
- ◆ Adapter -VAG 1318/11-
- ◆ Adapter -VAG 1318/17-
- ◆ Torquemeter - 40 to 200 Nm (socket 1/2") -VAG 1332-
- ◆ Injection rate comparison meter -VAG 1348-



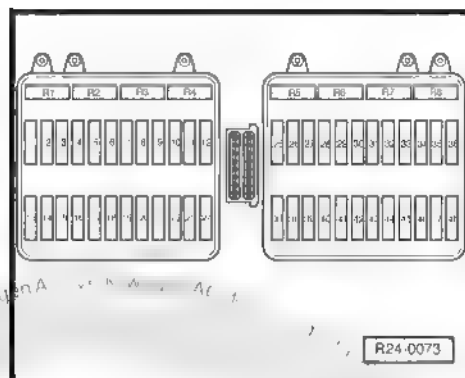
Special tools and workshop equipment required

- ◆ Control system for relay-controlled current circuits -VAG 1466A-
- ◆ Test tip -EQ 7300- or Test tip -VAG 1527B-
- ◆ Measurement auxiliary cable set -VAG 1594C-
- ◆ Multimeter -VAG 1715-
- ◆ Scaled container
- ◆ ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Checking conditions

- Fuse number 33, regular
- Tension of the Battery -A- at least 11.5 Volts.
- All power consuming components, like lights and rear window heating, must be off
- In vehicles with air conditioning, it must be off



1.9.1 Check the power supply operation



Note

During this work, the earth cable of the Battery -A- must be disconnected. Check whether the vehicle has coded radio. If this is the case, request the anti-theft code.

- Fold backseat forward.
- Remove cover below the seat.
- Turn the ignition system on. A Fuel system pressurization pump -G6- must be audible for a short period of time - approx. 1 second.

If the Fuel system pressurization pump -G6- does not work:

- Turn the ignition off.
- Disconnect the connector from the first cylinder injection valve.
- Connect the Remote control -VAG 1348/3A- to the injector valve connector for cylinder 1 and the red clamp at the Battery -A-, positive terminal (+).
- Activate Remote control -VAG 1348/3A-.

If the Fuel system pressurization pump -G6- works:

- Functional check of Fuel pump relay -J17-, in accordance with ⇒ Current flow diagrams, Electrical fault finding and Fitting locations, using the Control system for relay-controlled current circuits -VAG 1466A- :

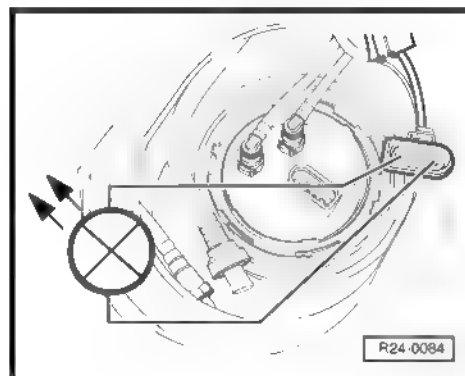
If the Fuel system pressurization pump -G6- does not work:

- Disconnect the 4-pole connector from Fuel system pressurization pump -G6-.
- Connect the Test tip -EQ 7300- or Test tip -VAG 1527B- to the connector's outer contacts
- Activate Remote control -VAG 1348/3A-. Diode lamp shall turn on

If the LED does not light up:

- Locate and eliminate cable cuts, proceeding according to the ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

LED lights up (correct electrical supply):

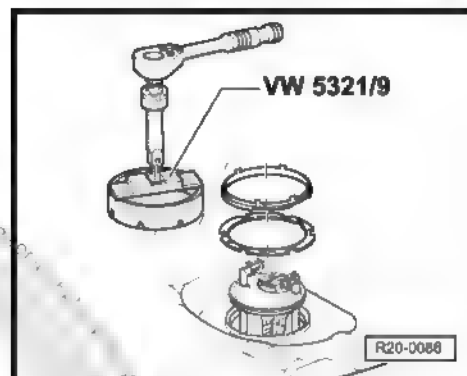




- Remove the Fuel system pressurization pump -G6- with Wrench or T 10334 -VW 5321/9- .
- Check if the cables are coupled to Fuel system pressurization pump -G6- .

In case there is no cable interruption:

- Fuel system pressurization pump -G6- damaged, replace
→ [page 114](#) .



1.9.2 Check fuel pump flow:

Checking conditions:

- The power supply must be OK.
- Adaptor cable -VAG 1348/3A- , connected.

Checking procedure:

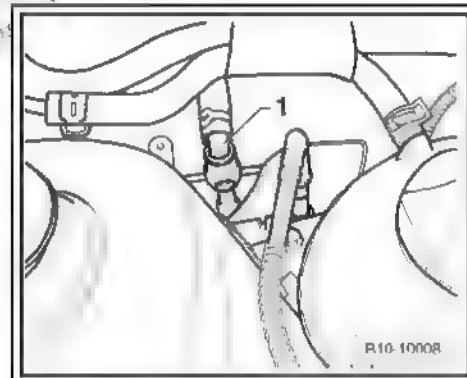
- Remove cover from fuel supply nozzle.



WARNING

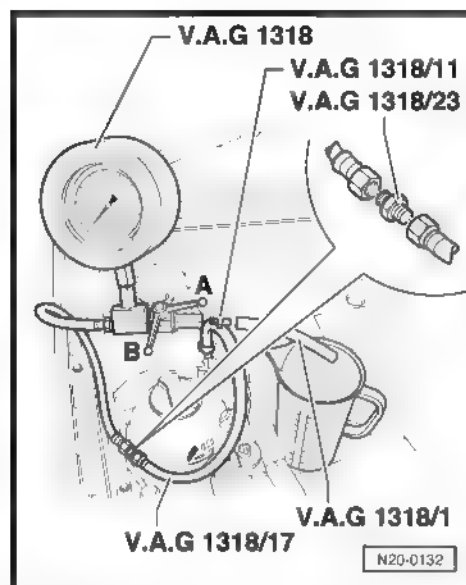
Fuel supply pipe is under pressure. Before loosening hose joints, place a cloth around them. Then eliminate the pressure by carefully removing the hose.

- Disconnect the fuel hose coupling -1- and collect any leaked fuel with a cloth.
- Connect the Pressure tester -VAG 1318- to fuel supply tube, using the adapters Connector -VAG-1318/23- and Adapter -VAG 1318/17- .





- Connect the hose of Pressure tester -VAG 1318- to Adapter -VAG 1318/11- and Adapter -VAG 1318/1- of Pressure tester -VAG 1318- and place its end in a measuring container with a 3 liter minimum capacity.
- Open the shut-off cock of the Pressure tester -VAG 1318-. The shut-off cock indicates the flow direction -A-.
- Activate Remote control -VAG 1348/3A-, slowly closing the shut-off cock, until the Pressure tester -VAG 1318- indicates a pressure of 4.2 bar. From this moment on, do not change the position of the shut-off cock.
- Empty the measurement container.
- Flow from Fuel system pressurization pump -G6- depends on voltage of Battery -A-. To do so, connect Multimeter -VAG 1715- to Battery -A- of the vehicle, using the Measurement auxiliary cable set -VAG 1594C-.
- Activate Remote control -VAG 1348/3A- for 30 seconds, measuring the tension of the Battery -A-.



- Compare the fuel flow to nominal value.

14) Minimum quantity $\text{cm}^3/30 \text{ s}$.

15) Voltage at Fuel system pressurization pump -G6- with the engine stopped and Fuel system pressurization pump -G6- operating (approx. 2 volts less than the voltage of Battery -A-).

Reading examples:

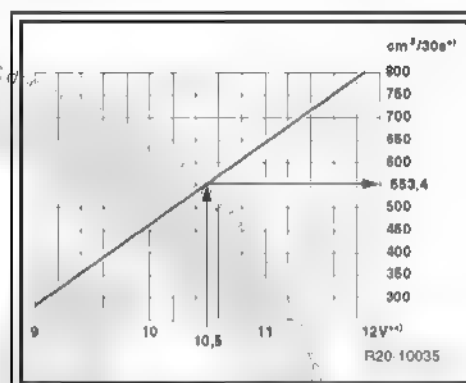
During checking, a 12.5 V tension is measured at the Battery -A-. Since at the Fuel system pressurization pump -G6- tension is 2 Volts lower than at the Battery -A-, the result is a minimum supply flow of 553.4 $\text{cm}^3/30 \text{ s}$.

If minimum flow is not reached:

- Check if filter intake tubing shows restrictions (folds) or obstructions.

If fuel tubing is in order.

- Check fuel flow before the fuel filter.



WARNING

Fuel supply tubing is under pressure. Before loosening the hose connections, a cleaning cloth should be placed on the connecting points. Then, release the pressure by pulling the hose carefully.

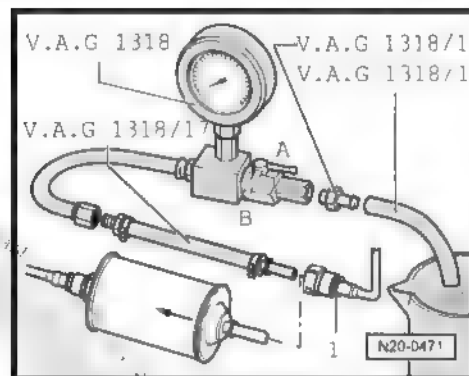


Note

To do so, push keys on hose closures.



- Release supply hose -1- at the intake of the fuel filter and connect to Adapter set -VAG 1318/17- .
- Pressure tester -VAG 1318- with Adapter set -VAG 1318/17- as indicated.
- Install the adapter -V.A.G 1318/16- on the adapter -V.A.G 1318/11- of Pressure tester -VAG 1318- and place its end in a measuring container with a 3 liter minimum capacity.
- Open the shut-off cock of the Pressure tester -VAG 1318- . The shut-off cock points in the direction of the fuel flow-A-.
- Activate Remote control -VAG 1348/3A- , slowly closing the shut-off cock, until the Pressure tester -VAG 1318- indicates 4.2 bar. Do not change the position of the shut-off cock.
- Empty the measurement container.
- Check the flow again.
- Activate anew the Remote control -VAG 1348/3A- for 30 seconds. Compare flow value with that obtained by the first measurement.



If minimum flow is not reached:

- Remove the Fuel system pressurization pump -G6- and check if there is soil on the screen filter.

If the minimum flow is reached:

- Replace the fuel filter.

If minimum flow is not reached:

Only if no irregularity has been observed this far:

- Fuel system pressurization pump -G6- damaged, replace Fuel system pressurization pump -G6- [⇒ page 114](#) .

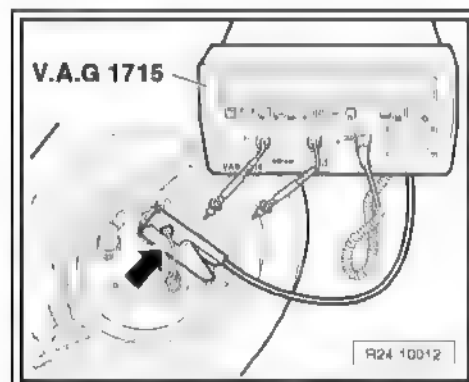
If desired fuel flow is reached, albeit with difficulty, it may be concluded that fuel supply is irregular (e.g.: a momentary fuel supply fault):

- Connect again disassembled fuel tubes.

- Using a current claw, connect the Multimeter -VAG 1715- to the 4-pin connector cable, pin 1, -arrow- of the wiring harness.
- Start engine and let it run in low rpm.
- Measure the current consumed by Fuel system pressurization pump -G6- . Theoretical value: maximum 8.2 A.

If current consumption is excessive:

- Fuel system pressurization pump -G6- damaged, replace Fuel system pressurization pump -G6- [⇒ page 114](#) .



1.9.3 Inspect the retention valve of Fuel system pressurization pump -G6-

Checking procedure:

This inspection tests, simultaneously, the supply hose connections from Fuel system pressurization pump -G6- to the connection to Pressure tester -VAG 1318- for leaks.

- Release supply hose -1- at the intake of the fuel filter and connect to Adapter set -VAG 1318/17- and Pressure tester -VAG 1318- .



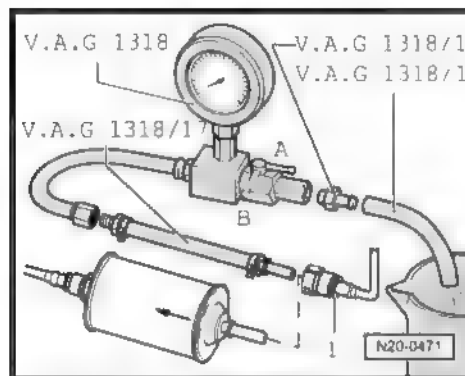
- Install the Adapter -VAG 1318/16- on the Adapter -VAG 1318/11- of Pressure tester -VAG 1318- and put the tip of the hose on a 3-liter measurement container.



Note

To do so, push the buttons of the hose connections.

- Close the shut-off cock of the Pressure tester -VAG 1318- (shut-off cock across flow direction - position -B-).
- Activate Remote control -VAG 1348/3A- in successive brief intervals up to a pressure of approximately 4.2 bar.



WARNING

The fuel system is under pressure; when opening the shut-off cock, hold a container in front of the free connection of the pressure measuring device.

- Reduce excessive pressure by carefully opening the shut-off cock.
- Watch the pressure drop on Pressure tester -VAG 1318-. After 10 minutes, the pressure shall not drop less than 2.5 bar.

If pressure continues dropping:

- Check the hose connections for leakages.

If no irregularity is found:

- Fuel system pressurization pump -G6- damaged, replace Fuel system pressurization pump -G6- ⇒ [page 114](#).



2 Engine power electronic regulation (electronic throttle) - check

1 - Pedal support

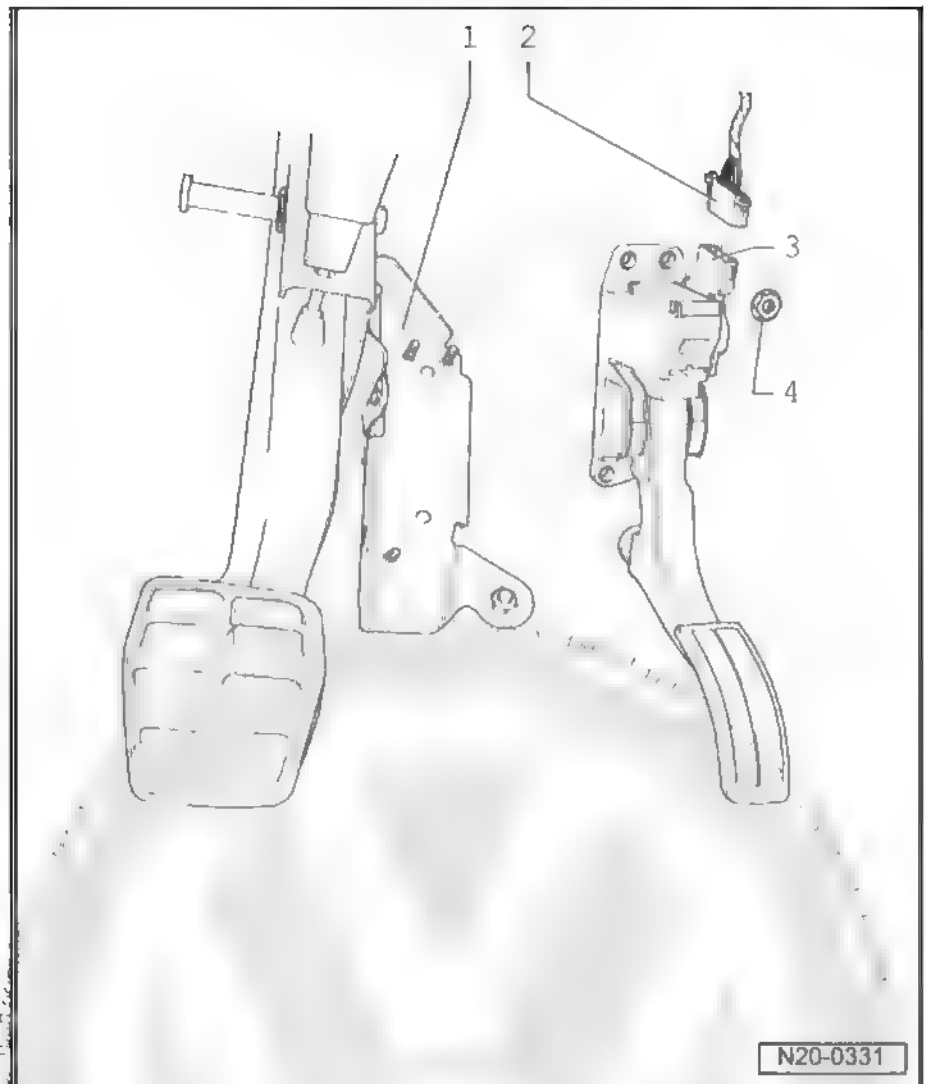
2 - Connector

□ Black

□ 6 poles

3 - Accelerator position sender
-G79- and Accelerator position
sender 2 -G185-

4 - 10 Nm



2.1 Electronic throttle system operation

In electronic throttle, the throttle valve is not started by cable. There is no mechanical connection between the throttle and the throttle valve.

The throttle position is transmitted to Engine control unit -J623- through two throttle position sensors (variable resistances, housed in a casing), that are connected to the accelerator.

Throttle position (at the driver's discretion) is the main input to Engine control unit -J623-.

The butterfly valve is activated by means of an electric motor (butterfly element) built into Throttle valve module -J338-, in all rotation and load intervals

The butterfly valve is activated by the butterfly element based on the data provided by Engine control unit -J623-.

With the engine off and the ignition connected, Engine control unit -J623- activates the butterfly element based on the data provided by Accelerator position sender -G79- and Accelerator position sender 2 -G185-. This means that when the accelerator is half-



way depressed, the throttle element opens proportionally, also opening the throttle valve halfway.

With the engine running (with load), Engine control unit -J623- can open or close the butterfly, regardless of the Accelerator position sender -G79- and Accelerator position sender 2 -G185-.

This way, the throttle valve may, for example, be completely opened, even though the throttle is halfway activated. The advantage is avoiding losses by choking, caused by the throttle valve.

Besides that, levels of consumption and pollutant emissions can be reduced for certain load conditions

The needed torque can be obtained by Engine control unit -J623-, by means of an optimal combination between the butterfly valve opening and the overfeeding pressure.

It would be a mistake to believe the electronic throttle is composed by one or two components only. The electronic throttle is a system composed of all components that contribute to determine the butterfly valve's position to adjust and activate it such as, for example, the throttle pedal position sensor, Throttle valve module -J338-, the EPC lighted indicator, Engine control unit -J623-, etc).

Follow the safety measures ⇒ [page 106](#).

Observe the cleaning rules ⇒ [page 107](#).





3 Activated charcoal filter system

3.1 Function

Depending on air temperature and pressure fuel fumes formed above fuel container surface.

Activated charcoal system filter prevents these carbon hydroxide emissions to reach the air we breathe.

Fuel fumes reach, in reduced quantities, the activated charcoal filter, from the highest container points, through the gravity valve (that closes at a 45° angle) and the pressure maintaining valve.

Activated charcoal absorbs these fumes like a sponge.

While the vehicle is operating and with the lambda adjustment active (warm engine), Activated charcoal filter solenoid valve 1 - N80, also called the regeneration valve, is activated cyclically by Engine control unit -J623-, based on the load and on the rotation system. The opening time depends on the input signals.

During the purging procedure (activated charcoal regeneration), fresh air is aspirated through the ventilation openings in the lower part of the activated charcoal filter due to the vacuum at the intake manifold. The fuel steam stored in the activated charcoal and the fresh air are added to the combustion in dosed portions.

The pressure retention valve prevents, with Activated charcoal filter solenoid valve 1 -N80- open and if there is vacuum in the intake manifold, fuel vapors from being sucked in directly from the tank. It ensures, therefore, the priority evacuation of the activated charcoal filter.

Without any current (e.g. harness interruption) Activated charcoal filter solenoid valve 1 -N80- remains closed. The activated charcoal filter will not be purged.



Note

- ◆ The hose connections are fixed by spring clamps.
- ◆ To install the spring clamps, it is recommended you use Standard type clamp pliers -VW 5162 (VWB) - or - VAS 5024A-.

Follow the safety measures ⇒ [page 106](#).

Observe the cleaning rules ⇒ [page 107](#).



3.2 Activated charcoal filter system components - repair

1 - Ventilation tubes

- ❑ Ensure proper fastening.

2 - Pressure check valve with connecting hose

- ❑ Ensure proper fastening.
- ❑ Of gravity valve in the fuel container.

3 - Activated charcoal filter

- ❑ Installation location: On right rear wheel box.

4 - Ventilation connection

- ❑ Visible from below.

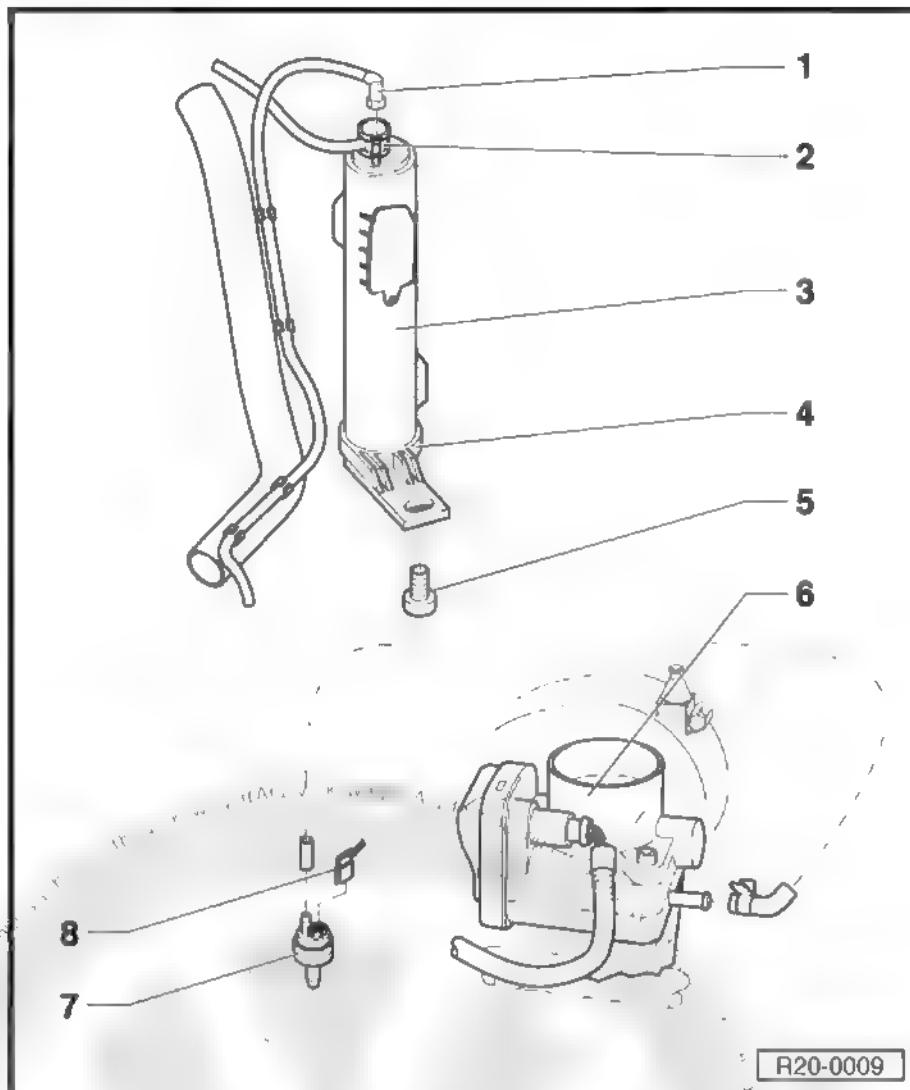
5 - 10 Nm

6 - ?Intake manifold with Throttle valve module -J338-

7 - The activated charcoal reservoir solenoid valve 1 -N80-

- ❑ A The activated charcoal reservoir solenoid valve 1 -N80- will close when ignition is off.
- ❑ A The activated charcoal reservoir solenoid valve 1 -N80- is activated (by pulses) by Engine control unit -J623- when the engine is at operating temperature.

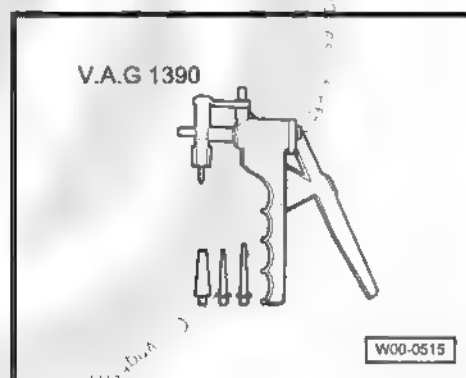
8 - Connector



3.3 Fuel tank ventilation - check

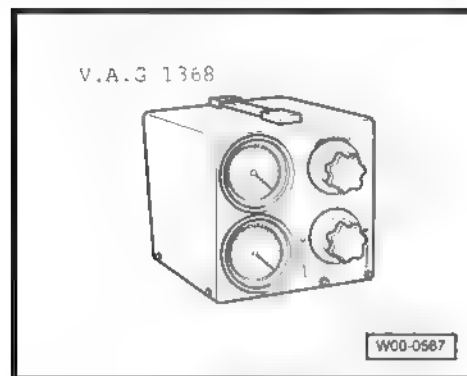
Special tools and workshop equipment required

- ◆ Vacuum tester -VAG 1368-





◆ Vacuum pump -VW 1390 (VWB) - or - VAS 6213-



Test conditions:

- Ignition shall be turned off.

Test sequence:

- Remove fuel tank cap.
- Release air ventilation hose -1- from the activated carbon filter. The activated charcoal reservoir solenoid valve 1 -N80- -2-.
- Connect the Vacuum pump -VW 1390 (VWB) - or - VAS 6213- and Vacuum tester -VAG 1368- as shown on hose -1-.
- Place vacuum tester in position -A/B-.
- Activate, several times, Vacuum pump -VW 1390 (VWB) - or - VAS 6213- . Any vacuum should be created.

If there is vacuum:

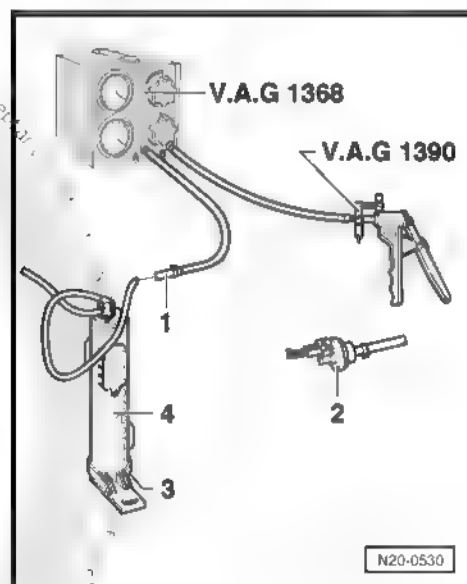
- Check if ventilation hose -3- from activated carbon filter -4- is dirty. If necessary, clean it.

If there is no vacuum:

- Cover ventilation hose -3- and activate the vacuum pump again several times. Vacuum must be created.

If there is no vacuum:

- Replace the activated charcoal filter.





24 – Fuel supply - injection system

1 Injection system - repair

1.1 General indications about injection

- ◆ A Engine control unit -J623- is equipped with self-diagnosis. Prior to performing repairs and localizing faults, consult the fault memory. The vacuum hoses and connections shall be checked (air infiltration) the same way.
- ◆ Fuel hoses in the engine compartment shall only be fixed with spring clamps. Use of retaining braces or screw braces is not allowed.
- ◆ Minimum voltage of 11.5 V is necessary for the proper operation of electric components.
- ◆ Do not use sealants that contain silicone. Silicone residues sucked in by the engine are not burned and damage Lambda probe -G39-.
- ◆ In case of a power supply cut or a fault memory failure, the READINESS code must be regenerated.

Safety measures ⇒ [page 146](#) .

Rules for cleanliness ⇒ [page 147](#) .

Technical data ⇒ [page 147](#) .

1.2 Component location

Engines: BAH, BLH, BJA, BPA and CFZA

Components A to D are not represented in the illustration.



A - Brake pedal switch -F47-

- ☐ In the foot well, on the break pedal.

B - Accelerator position sender -G79- and Accelerator position sender 2 -G185-

- ☐ At the foot well, at the throttle pedal
→ [page 127](#) .

C - Clutch pedal switch -F36-

- ☐ In foot well on clutch pedal.

D - Fuel pressure regulator

- ☐ The Fuel system pressurization pump -G6- .

1 - Gasoline tank of the cold start system

- ☐ For BJA and BPA engines only.

2 - Connector

- ☐ Black, 3 poles.
- ☐ For Engine speed sender -G28- .

3 - Connector

- ☐ Black, 4 poles.
- ☐ For Intake manifold pressure sender -G71- with Intake air temperature sender -G42- .

4 - ?Intake manifold

- ☐ Remove and install
→ [page 142](#) .

5 - Knock sensor 1 -G61-

- ☐ Installation location: In the engine block on the intake side.

6 - Throttle valve module -J338-

7 - Engine speed sender -G28-

- ☐ Installation location: In the engine block on the intake side.

8 - Engine control unit -J623-

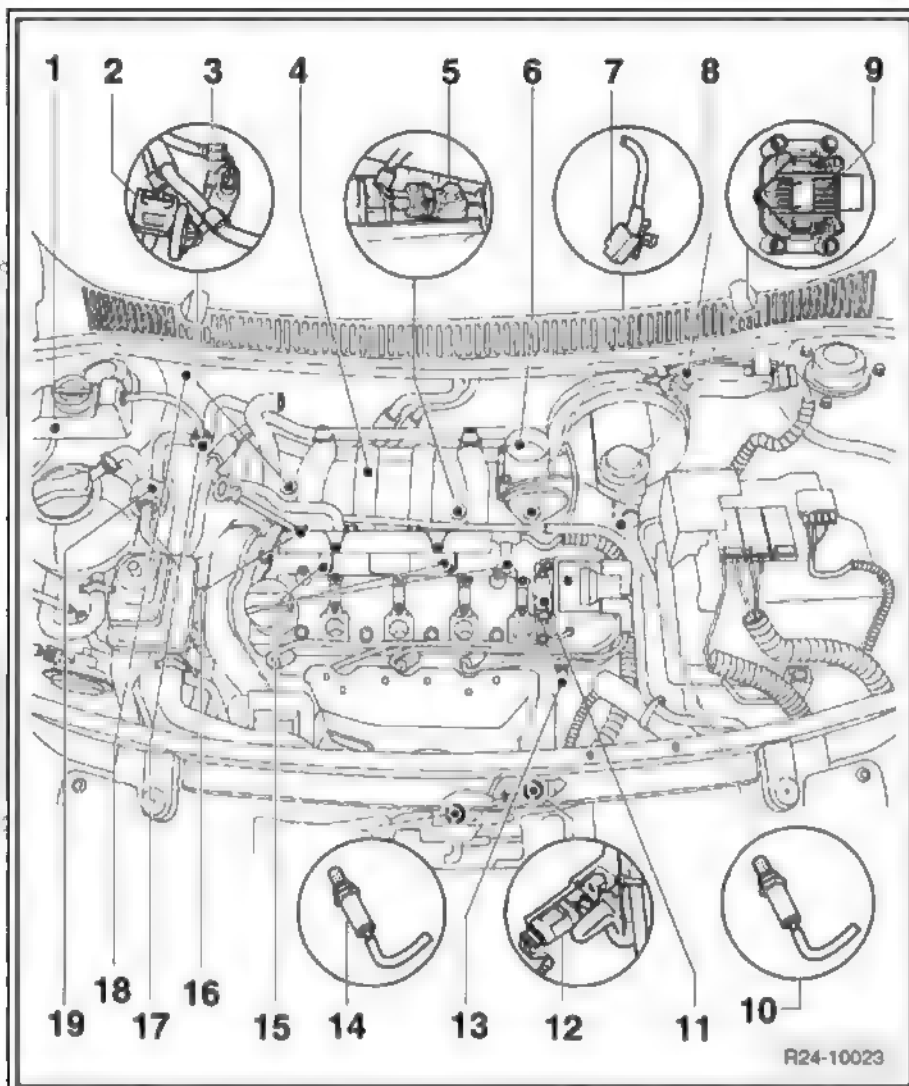
- ☐ Connect or remove the connector only when the ignition is turned off.
- ☐ Release to remove.
- ☐ With CCRA and CFZA engines, remove the lower windshield noise insulator.

9 - Ignition transformer -N152-

- ☐ With codes for ignition cables, do not mix up.
- ☐ → [Item 2 \(page 167\)](#) .

10 - Lambda probe after catalytic converter -G130-

- ☐ 50 Nm
- ☐ Installation location: On the exhaust pipe, next to the sleeve.
- ☐ For the BLH engine only.
- ☐ Installation location: On the front exhaust pipe tube, next to the catalyzer.
- ☐ Only for the Argentinean version of the CFZA engine.





11 - Hall sender -G40-

- ☐ ➔ [Item 8 \(page 167\)](#) .

12 - Connector

- ☐ Black, 4 poles.
- ☐ To Lambda probe -G39- 1 before the catalyzer and Lambda probe heating -Z19-

13 - Coolant temperature sender -G62-

14 - Lambda probe -G39- 1 before the catalyzer, 50 Nm

- ☐ Installation location: On the exhaust pipe, front section (BAH, BLH, BJA, and BPA engines).
- ☐ Installation location: On the exhaust manifold CCRA and CFZA.

15 - Injector, cylinder 1 -N30- , Injector, cylinder 2 -N31- , Injector, cylinder 3 -N32- and Injector, cylinder 4 -N33-

16 - Fuel distributor

17 - Valve

- ☐ For BJA and BPA engines only.

18 - Cold start valve -N17-

- ☐ For BJA and BPA engines only.

19 - The activated charcoal reservoir solenoid valve 1 -N80-

CCRA Engine

Components A to D are not represented in the illustration.

For this engine, models manufactured as from model-year 2011 are equipped with Lambda probe after catalytic converter -G130- .



A - Brake light switch -F-

- ☐ All in one housing in the footwell at the brake pedal.

B - Accelerator position sender -G79- and Accelerator position sender 2 -G185-

- ☐ At the foot well, at the throttle pedal
→ [page 127](#).

C - Clutch pedal switch -F36-

- ☐ In foot well on clutch pedal.

D - Fuel pressure regulator

- ☐ The Fuel system pressurization pump -G6-

1 - Gasoline tank of the cold start system

2 - Connector

- ☐ Black, 3 poles.
- ☐ For Engine speed sender -G28-.

3 - Connector

- ☐ Black, 4 poles.
- ☐ For Intake manifold pressure sender -G71- with Intake air temperature sender -G42-.

4 - Cold start valve -N17-

5 - ?Intake manifold

- ☐ Remove and install
→ [page 141](#).

6 - Knock sensor 1 -G61-

- ☐ Installation location: In the engine block on the intake side.

7 - Throttle valve module -J338-

- ☐ Connect or remove the connector only when the ignition is turned off.

8 - Connector to Engine speed sender -G28-

- ☐ To remove Engine speed sender -G28-, remove the intake manifold.

9 - Engine control unit -J623-

- ☐ Located under lower windshield lining.

10 - Ignition transformer -N152-

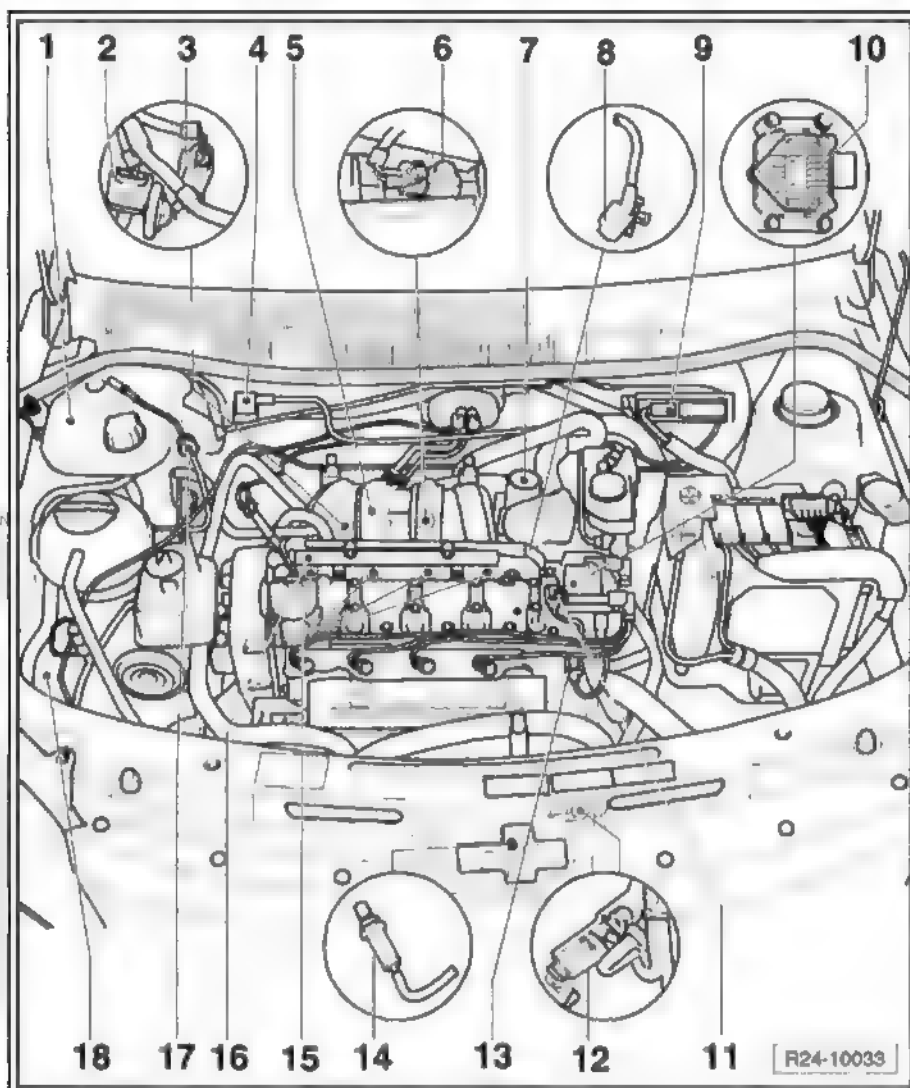
- ☐ With codes for ignition cables, do not mix up.
- ☐ → [Item 2 \(page 167\)](#).

11 - Hall sender -G40-

- ☐ → [Item 8 \(page 167\)](#).

12 - Connector

- ☐ Black, 4 poles.
- ☐ For Lambda probe -G39- before the catalyzer and Lambda probe heating -Z19-.





13 - Coolant temperature sender -G62-

14 - Lambda probe -G39-

❑ 50 Nm

❑ Located at the catalyzer, next to the exhaust manifold

15 - Injector, cylinder 1 -N30 - , Injector, cylinder 2 -N31 - , Injector, cylinder 3 -N32 - and Injector, cylinder 4 -N33-

16 - Fuel distributor

17 - Unidirectional valve

18 - The activated charcoal reservoir solenoid valve 1 -N80-

1.3 Injection components - remove and install

Engines: BAH, BLH, BJA, and BPA

A - Coolant temperature sender -G62-

❑ Installation location: On the coolant hose, next to the radiator.

❑ Of Engine control unit -J623- .

❑ If necessary, depressurize system before removal.

❑ Resistance values between contacts 1 and 2
⇒ [page 141](#)

❑ Black connector, 2 poles.

❑ Gold plated connector contacts.

1 - Connector

❑ To Engine control unit -J623- .

❑ Connect or disconnect the connector only when the ignition is turned off.

❑ Release to remove.

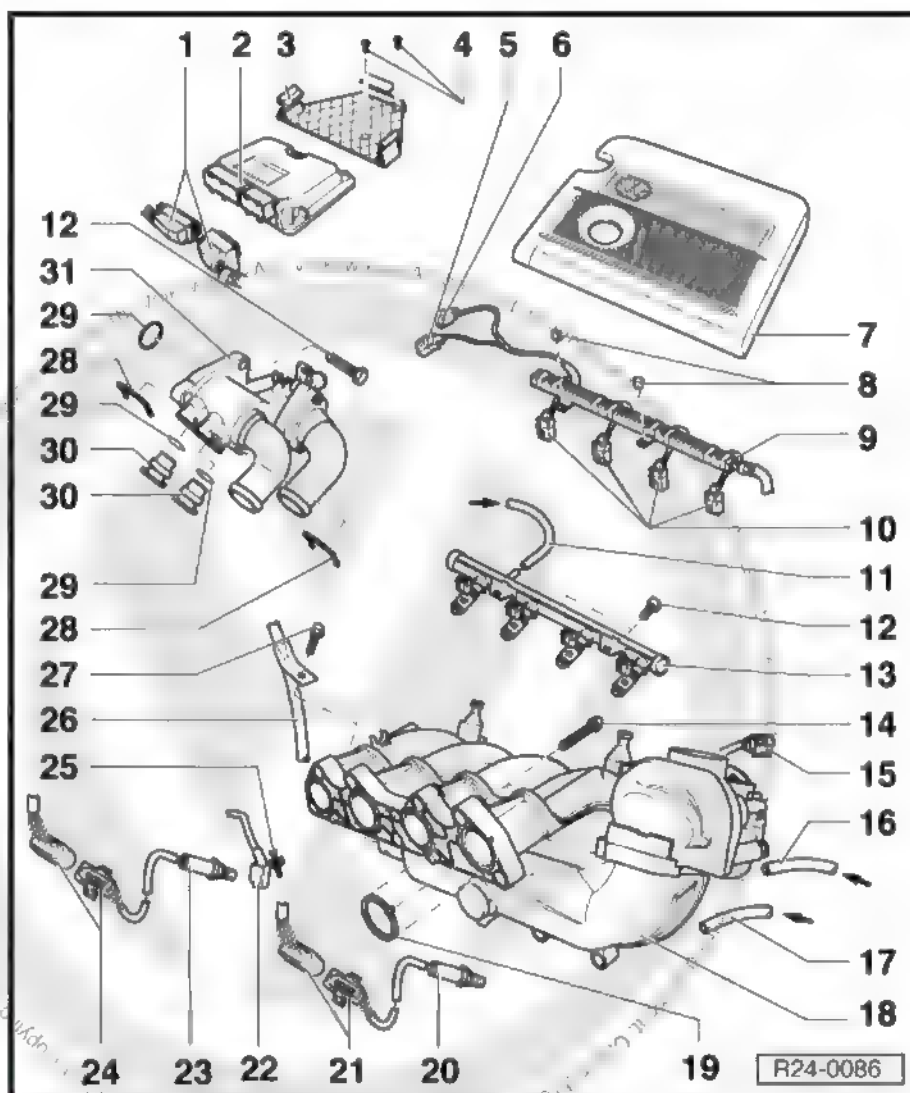
2 - Engine control unit -J623-

❑ For the injection system, lambda adjustment, The activated charcoal reservoir solenoid valve 1 -N80- , knock adjustment, rotation limitation, ignition, and self-diagnosis.

❑ When replacing, Engine control unit -J623- adjust to the Immobilizer control unit -J362- ⇒ [page 158](#) .

3 - Support

❑ Of Engine control unit -J623- .





4 - 3 Nm

5 - Connector

- ☐ Black, 4 poles.
- ☐ Of Intake manifold pressure sender -G71- with Intake air temperature sender -G42- .
- ☐ Gold plated connector contacts.

6 - Connector

- ☐ Black, 3 poles.
- ☐ Of Engine speed sender -G28- .

7 - Air cleaner set

- ☐ Remove and install the air filter assembly [⇒ page 144](#) , [⇒ page 144](#)
- ☐ Disassemble and assemble [⇒ page 142](#) .

8 - Fastening clamp

- ☐ Observe model.

9 - Cable guide

- ☐ Fastened to the fuel distributor.

10 - Connector

- ☐ Black, 2 poles.
- ☐ Of Injector, cylinder 1 -N30- , Injector, cylinder 2 -N31- , Injector, cylinder 3 -N32- and Injector, cylinder 4 -N33- .

11 - Feed tubing

- ☐ Black with white mark.
- ☐ Fasten with spring brace.
- ☐ Ensure proper fastening.
- ☐ Of fuel filter.

12 - 10 Nm

13 - Fuel distributor with injectors

- ☐ Remove and install [⇒ page 142](#) .

14 - 20 Nm

15 - Connector

- ☐ Black, 6 poles.
- ☐ Of Engine control unit -J623- .
- ☐ Gold plated connector contacts.

16 - Of The activated charcoal reservoir solenoid valve 1 -N80-

- ☐ Fasten with spring braces.

17 - From servo-brake

18 - ?Intake manifold

- ☐ Remove and install [⇒ page 141](#) .

19 - Seal ring

- ☐ Replace
- ☐ Observe installation position.

20 - Lambda probe -G39- 1 before the catalyzer, 50 Nm

- ☐ Installation location: On the exhaust pipe, front part.
- ☐ Only lubricate the thread with -G 052 112 A3- ; do not hit the body trims of Lambda probe -G39- .
- ☐ Remove and install with Socket kit for Lambda probe -3337- .
- ☐ Power supply for the heating of Lambda probe -G39- through Fuel pump relay -J17- .



21 - Fitting connector

- ☐ Black, 4 poles
- ☐ To Lambda probe -G39- 1 before the catalyzer and Lambda probe heating -Z19- .
- ☐ Contacts 3 and 4 are gold-plated.

22 - Engine speed sender -G28-

- ☐ Installation location: In the engine block on the intake side

23 - Lambda probe 2 -G108- behind the catalyzer, 50 Nm

- ☐ For the BLH engine only.
- ☐ Installation location: On the exhaust pipe, next to the sleeve.
- ☐ Only lubricate the thread with -G 052 112 A3- ; do not hit the body trims of Lambda probe 2 -G108- .
- ☐ Power supply for the heating of Lambda probe 2 -G108- through Fuel pump relay -J17- .
- ☐ During removal, remove the lower right-hand side floor cover and the cover of the 4-pole connector of Lambda probe 2 -G108- .
- ☐ Remove and install with Socket kit for Lambda probe -3337- .

24 - Fitting connector

- ☐ Brown, 4 poles.
- ☐ To Lambda probe 2 -G108- after the catalyzer and Lambda probe heating -Z19- .
- ☐ Contacts 3 and 4 are gold-plated.

25 - 5 Nm

26 - Guide tube

- ☐ for the oil dipstick.

27 - 3 Nm

28 - Clip

- ☐ Ensure proper fastening.

29 - Seal ring

- ☐ Replace.

30 - Plug

- ☐ If necessary, depressurize system before removal.

31 - Cooling system thermostatic valve body

Engines CCRA and CFZA

For this engine, models manufactured as from model-year 2011
are equipped with Lambda probe after catalytic converter -G130- .



1 - Connector

- ☐ To Engine control unit - J623- .
- ☐ Connect or disconnect the connector only when the ignition is turned off.
- ☐ Release to remove.

2 - Engine control unit -J623-

- ☐ For injection system, lambda probe regulation, activated charcoal filter electromagnetic valve, detonation regulation, rotation limit, ignition and self-diagnosis.
- ☐ When replacing, Engine control unit -J623- adjust to the Immobilizer control unit -J362-
⇒ [page 158](#) .

3 - Connector

- ☐ Black, 4 poles.
- ☐ Of Intake manifold pressure sender -G71- with Intake air temperature sender -G42- .
- ☐ Gold plated connector contacts.

4 - Connector

- ☐ Black
- ☐ 3 poles
- ☐ Of Engine speed sender -G28- .

5 - Air cleaner set

- ☐ Disassemble and assemble ⇒ [page 142](#) .

6 - Fastening clamp

- ☐ Observe model.

7 - Cable guide

- ☐ Fastened to the fuel distributor.

8 - Connector

- ☐ Black, 2 poles.
- ☐ Of Injector, cylinder 1 -N30- , Injector, cylinder 2 -N31- , Injector, cylinder 3 -N32- and Injector, cylinder 4 -N33- .

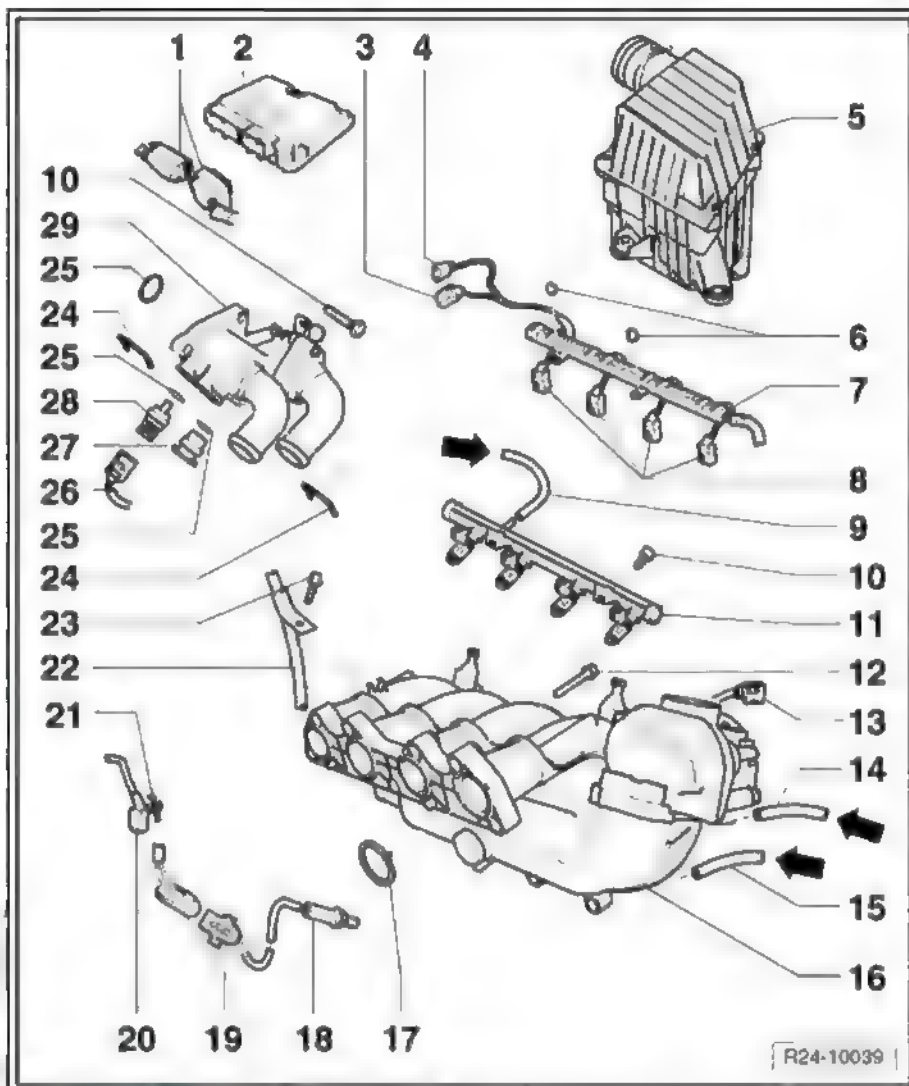
9 - Intake tubes

- ☐ Black with white mark.
- ☐ Fasten with spring braces.
- ☐ Ensure proper fastening
- ☐ Of fuel filter.

10 - 10 Nm

11 - Fuel distributor with injectors

- ☐ Remove and install ⇒ [page 142](#)



R24-10039



12 - 20 Nm

13 - Connector

- ☐ Black
- ☐ 6 poles
- ☐ Of Throttle valve module -J338- .
- ☐ Gold plated connector contacts.

14 - Of The activated charcoal reservoir solenoid valve 1 -N80-

- ☐ Fasten with spring braces.

15 - From servo-brake

16 - ?Intake manifold

- ☐ Remove and install ➔ [page 141](#) .

17 - Seal ring

- ☐ Replace.
- ☐ Observe installation position.

18 - Lambda probe -G39- before the catalyzer

- ☐ 50 Nm
- ☐ Installation location: On the exhaust pipe, front part.
- ☐ Only lubricate the thread with High temperature paste -G 052 112 A3- ; pay attention to the High temperature paste -G 052 112 A3- do not hit the body trims of Lambda probe -G39- .
- ☐ Remove and install with Socket kit for Lambda probe -3337- .
- ☐ Power supply for the heating of Lambda probe -G39- through Fuel pump relay -J17- .

19 - Connector

- ☐ Black, 4 poles.
- ☐ To Lambda probe -G39- before the catalyzer and Lambda probe heating -Z19- .
- ☐ Contacts 3 and 4 are gold-plated.

20 - Engine speed sender -G28-

- ☐ Installation location: In the engine block near the gearbox, on the intake side.

21 - 5 Nm

22 - Guide tube

- ☐ for the oil dipstick.

23 - 3 Nm

24 - Clip

- ☐ Ensure proper fastening.

25 - Seal ring

- ☐ Replace.

26 - Connector

- ☐ Black
- ☐ ,4 poles.
- ☐ Of Coolant temperature sender -G62- .
- ☐ Gold plated connector contacts.

27 - Plug

- ☐ If necessary, depressurize system before removal.

28 - Coolant temperature sender -G62-

- ☐ Of Engine control unit -J623- .
- ☐ If necessary, depressurize system before removal.
- ☐ Resistance values between contacts 1 and 2 ➔ [page 141](#)



29 - Cooling system thermostatic valve body

Resistance values of Coolant temperature sender -G62-

The diagram is divided into two temperature ranges:

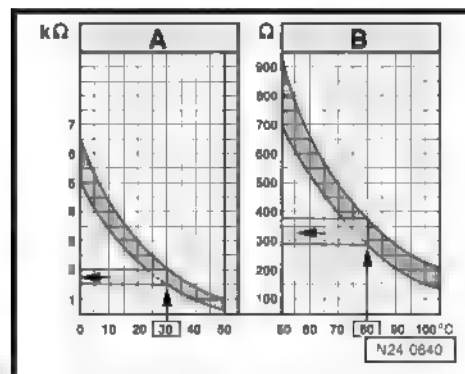
A - from 0...50 °C

B - from 50...105 °C

Reading example:

◆ 30 °C is in area A and corresponds to a resistance of 1.5...2.0 kΩ

◆ 80 °C is in area B and corresponds to a resistance of 275...375 Ω



1.4 Intake manifold - remove and install

1 - Seal ring

- ☐ Replace if damaged.

2 - Throttle valve module - J338-

- ☐ When replacing, adjust Engine control unit - J623- to Throttle valve module - J338-
⇒ [page 158](#).

3 - 10 Nm

4 - 20 Nm

5 - Intake manifold

6 - Seal ring

- ☐ Replace.
- ☐ Observe installation position.

7 - Seal ring

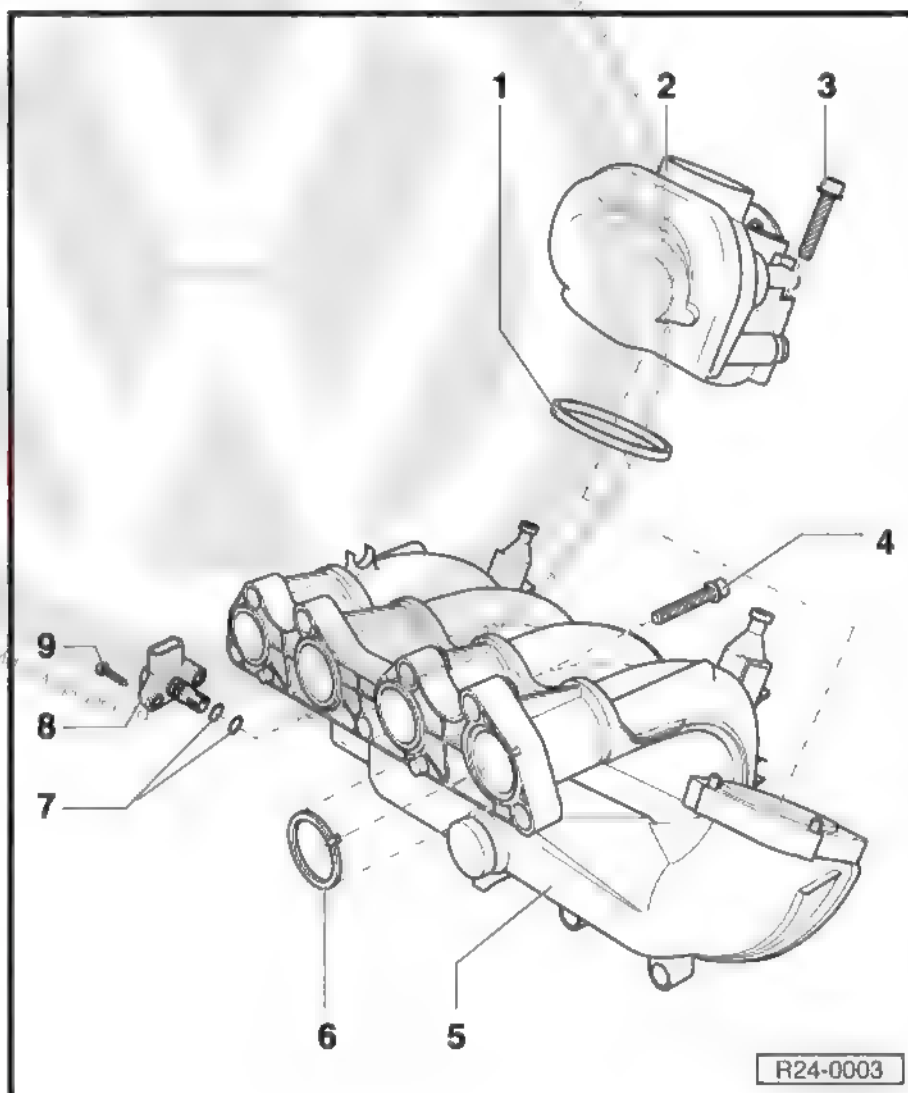
- ☐ Replace if damaged.

8 - Intake manifold pressure sender -G71- with Intake air temperature sender -G42-

- ☐ Resistance values of Intake air temperature sender -G42- between contacts 1 and 2
⇒ [page 142](#)

9 - 3 Nm

- ☐ Follow the installation indications
⇒ [page 144](#).





Resistance values of Intake air temperature sender -G42-

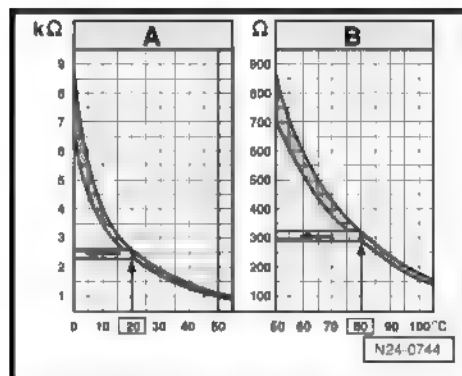
The diagram is divided into two temperature ranges:

A - from 0...50 °C.

B - from 50...105 °C

Reading example:

- ◆ 20 °C is in area A and corresponds to a 2.3...2.6 kΩ.
- ◆ 80 °C is in area B and corresponds to a resistance of 290...330 Ω



1.5 Fuel distributor with injectors - remove and install

1 - Fuel distributor

- ☐ Remove and install
⇒ [page 149](#).
- ☐ Check the fuel pressure
regulator ⇒ [page 152](#).

2 - 10 Nm

3 - Clip

- ☐ Ensure proper fasten-
ing.
- ☐ Assure correct seating
in injector valve and fuel
distributor.

4 - Seal ring

- ☐ Replace if damaged.
- ☐ Before installation,
slightly lubricate with
clean engine oil.

5 - Injector, cylinder 1 -N30-, Injector, cylinder 2 -N31-, In- jector, cylinder 3 -N32- and In- jector, cylinder 4 -N33-

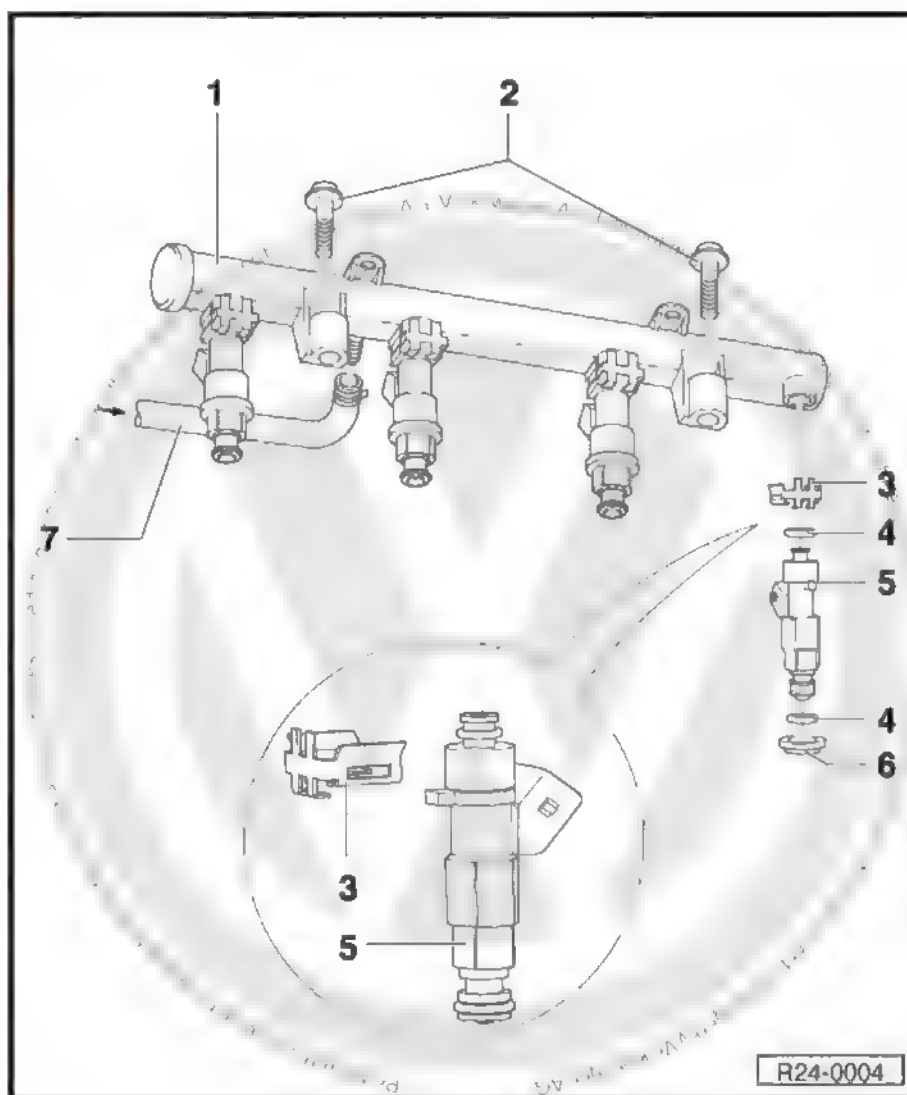
- ☐ Resistance between the
valve contacts: 12... 17
Ω.

6 - Seal ring

- ☐ Observe installation po-
sition.
- ☐ Replace when dam-
aged.

7 - Intake tubes

- ☐ Black with white mark
- ☐ Fasten with spring bra-
ces
- ☐ Ensure proper fastening.
- ☐ Of fuel filter.



1.6 Air filter - disassemble and assemble

Remove and install the air cleaner housing ⇒ [page 144](#)
⇒ [page 144](#)



Engines: BAH, BLH, BJA, and BPA

1 - Lower part of air cleaner housing

2 - Rubber base

3 - 3 Nm

- ☐ Follow the installation indications
→ [page 144](#) .

4 - Seal ring

- ☐ Closely observe firm seating.
- ☐ Replace when damaged.

5 - Intake air nozzle

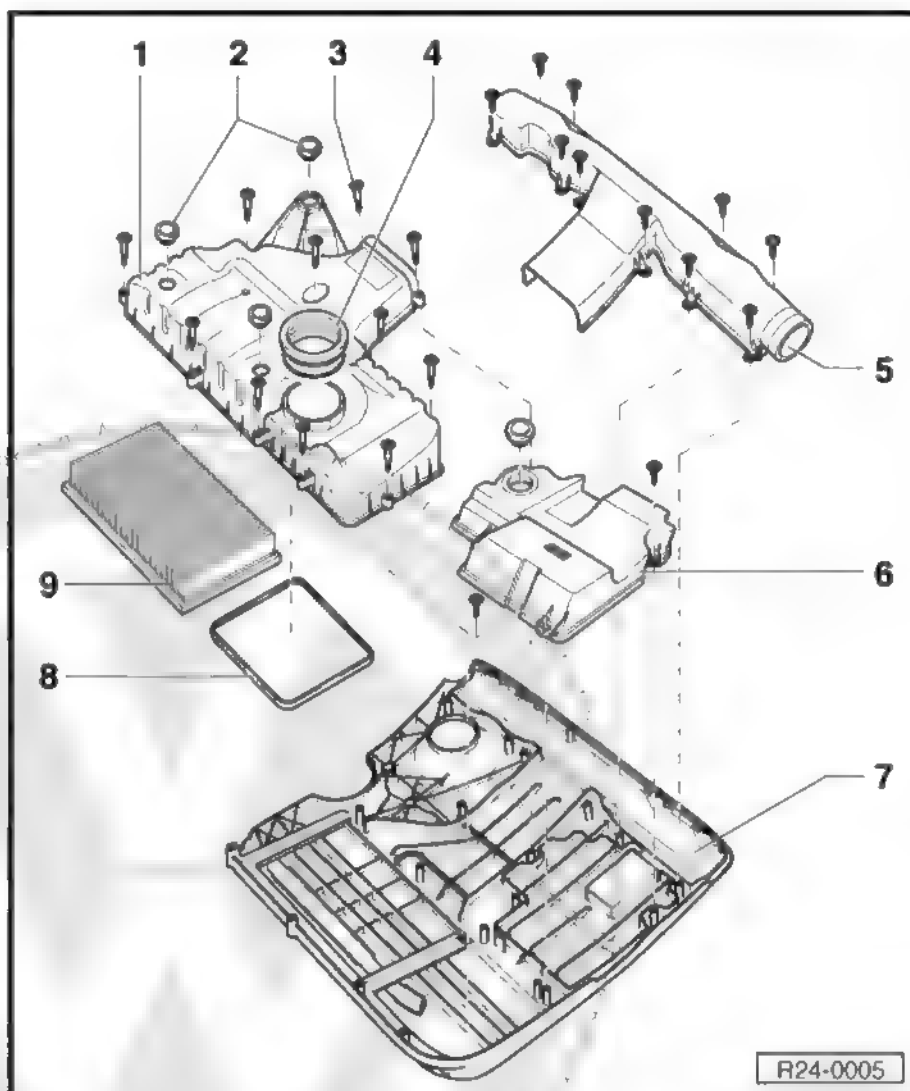
6 - Cover

7 - Upper part of air cleaner housing

8 - Seal gasket

- ☐ Observe installation position.
- ☐ Replace when damaged.

9 - Filter element



Engines: CCRA and CFZA



1 - Air duct

2 - Clamp

- Remove with Pliers for
clamps of the Standard
Type or VAS 5024A -
VW 5162- .

3 - Air filter upper cover

4 - 1.6 Nm

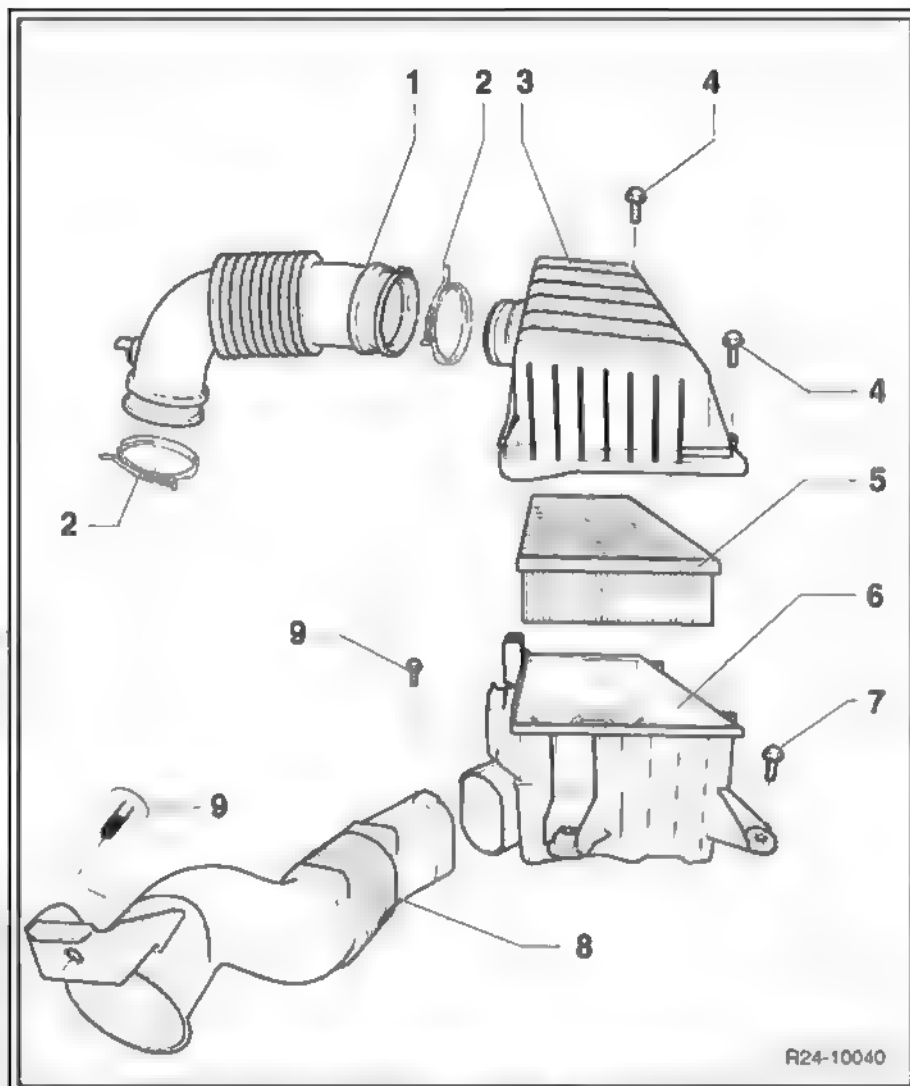
5 - Filtering element

6 - Air filter lower cover

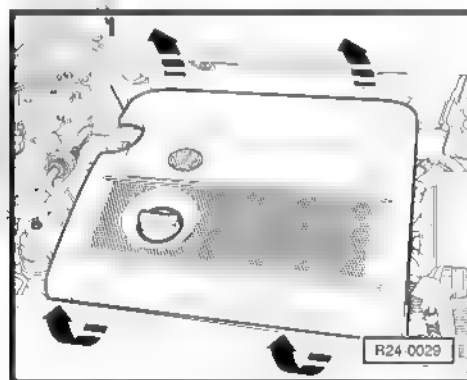
7 - 8 Nm

8 - Intake air nozzle

9 - 1.5 Nm



Remove and install the air cleaner housing: BAH, BLH, BJA, and BPA engines)



1.6.1 Removal

- Remove the air ventilation hose from oil sump -1- from air filter casing.
- Remove the ventilation hose from Cold start valve -N17- from the left side of the filter casing (Engines BJA and BPA).
- Remove the air filter assembly from the supports and from Throttle valve module -J338- -arrows- and remove the air cleaner assembly



1.6.2 Installation

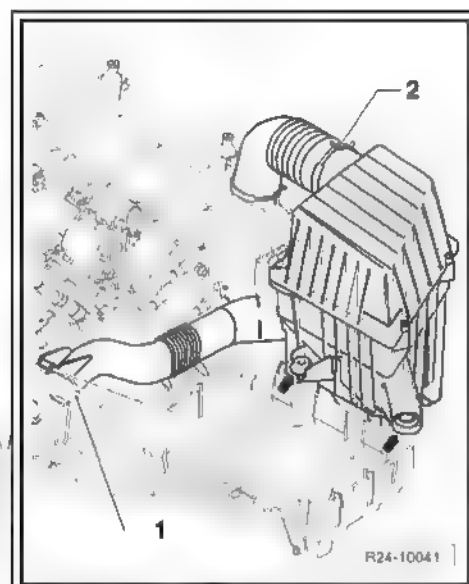
- Installation is carried out in the reverse order of removal.



Note

- ◆ To attach the upper part of the filter assembly on the filter base as well as the air intake nozzles and Intake air temperature sender -G42- / Intake manifold pressure sender -G71-, series self-locking screws are used. If these screws are loosened or tightened with a screwing machine, the threads on the upper part of the air cleaner assembly may be damaged.
- ◆ For this reason, the use of a power screwdriver is only allowed when
- ◆ power screwdriver rotation is 200 rpm at most.
- ◆ a maximum tightening torque of 3 Nm is set.

Engines: CFZA



1.6.3 Removal

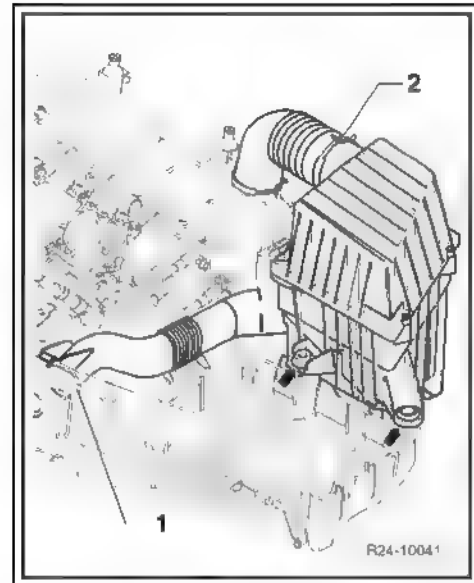
- Remove air intake duct -1-.
- Release spring clamp -2- with Pliers for clamps of the Standard Type or VAS 5024A -VW 5162- and remove the air duct from the upper part of the air filter assembly.
- Remove the screw-arrows- that attach the air filter assembly.
- Tilt the cover of Battery -A- forward.
- Move the air filter assembly upwards.
- Remove the air filter assembly.

1.6.4 Installation

- Seat air filter assembly on rubber mounts -arrows-



- Press the air cleaner downwards over the pins.
- Tighten securing screws with 8 Nm
- Fasten air duct with spring brace on upper part of air cleaner -2-.
- Install intake air duct onto the intake nozzle -1-.



1.7 Safety measures



WARNING

Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure, carefully removing hose and loosening closing bolt.

In order to avoid personal injury and/or damages to the injection and ignition system, observe the following:

- ◆ For safety reasons shall the fuse 33 be removed from the fuse box before opening the fuel system.
- ◆ Do not touch neither remove the ignition cables when the engine is running or when starting the engine.
- ◆ Only connect or disconnect the injection and ignition system cables (also the measurement equipment cables) when the ignition is turned off.



WARNING

For installation work, especially in the engine compartment, due to reduced existing space, consider the following.

- ◆ All hoses (e.g. fuel, hydraulic, activated charcoal filter system, coolant and refrigerant gas, brake fluid, vacuum) and electric cables must be arranged in a way to return to their original positions.
- ◆ Ensure easy access to all mobile parts that may be hot.

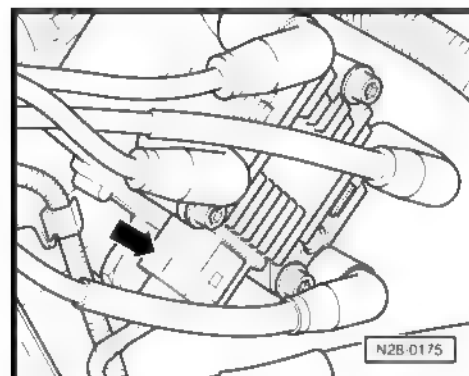
If, during a test drive, it becomes necessary to use test and measuring equipment, observe the following

- ◆ Test and measuring equipment must be placed on the back seat to be used by a second mechanic from there

If test and measuring equipment are operated on passenger seat, person seating there may be injured due to airbag activation in case of accident



- ◆ In case one wishes to run the engine with start rotation without operating
- Disconnect the 4-pole connector from flange ignition transformer -N152- -arrow- .

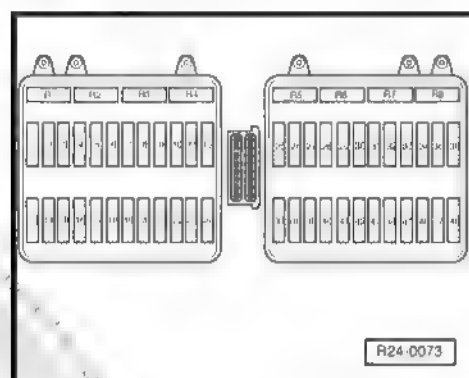


- Remove fuse 33 from fuse box.



Note

When fuse 44 is removed, power supply to injectors is interrupted.



1.8 Rules for cleanliness

For jobs on the fuel and injection system, strictly observe the following "5 cleaning" rules:

- ◆ Thoroughly clean the connections and surrounding areas before disconnecting them.
- ◆ Place the removed parts on a clean surface and cover them. Do not use fluffy cloths.
- ◆ If repair work is not immediately carried out, open components shall be covered and carefully reserved.
- ◆ Only install clean components. Remove the spare parts from their packaging just before installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With open system: whenever possible, avoid the use of compressed air. If possible, do not move the vehicle.

1.9 Technical data

Engine identification letters	BAH	BLH	BJA	BPA	CCRA/CFZA
Idle speed check					
Idle speed without air conditioning	710...810 ¹⁶⁾	710...810 ¹⁶⁾	710...810 ¹⁶⁾	710...810 ¹⁶⁾	710...810 ¹⁶⁾
Idle speed with air conditioning ¹⁷⁾	790...890 ¹⁶⁾	790...890 ¹⁶⁾	790...890 ¹⁶⁾	790...890 ¹⁶⁾	770...870 ¹⁶⁾
Engine control unit ¹⁸⁾					



Engine identification letters	BAH	BLH	BJA	BPA	CCRA/CFZA
System	ME 7 5 10 Bosch	ME 7 5 10 ²⁰⁾ Bosch	ME 7 5 10 Bosch	ME 7 5 10 ¹⁹⁾ Bosch	ME 7 5 30 Bosch
Part number of replacement part	→ replacement part CD	→ replacement part CD	→ replacement part CD	→ replacement part CD	→ replacement part CD
Rotation limit rpm	From approximately 5700	From approximately 5700	From approximately 5700	From approximately 5700	From approximately 6500

16) Not adjustable.

17) Not adjustable

18) Replace the Engine control unit -J623- ⇒ [page 157](#).


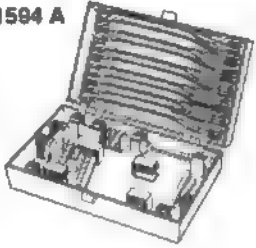
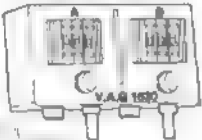
19) ME 7.5.20 as of 09 2006.

20) ME 7.5.20 as of 02 2006



2 Component check

2.1 Injection valves - check

<p>V.A.G 1331</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1630</p> 	
	<p>W24-0003</p>

Check blast shape and leak-proof capability

Special tools and workshop equipment required

- ◆ Torque wrench - 5 to 50 Nm (socket 1/2") -VAG 1331-
- ◆ Measurement auxiliary cable set -VAG 1594C-
- ◆ Digital potentiometer (included in VAG 1594C) -VAG 1630-
- ◆ Scaled container

Test conditions

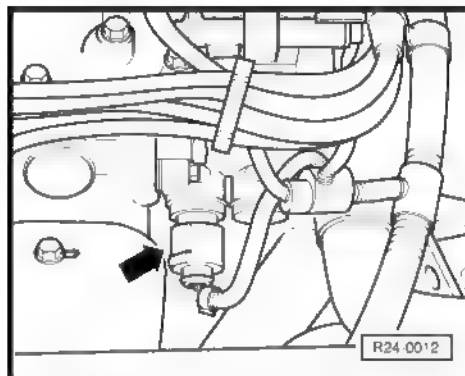
- Fuel pressure must be correct, check → [page 132](#).

Test sequence

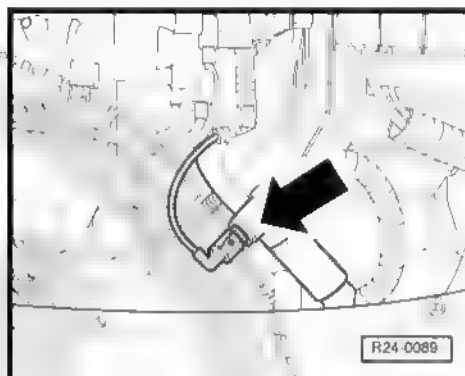
- Remove the air filter assembly → [page 144](#).
- Disconnect the 4-pole connector from flange Coolant temperature sender -G62- -arrow-.



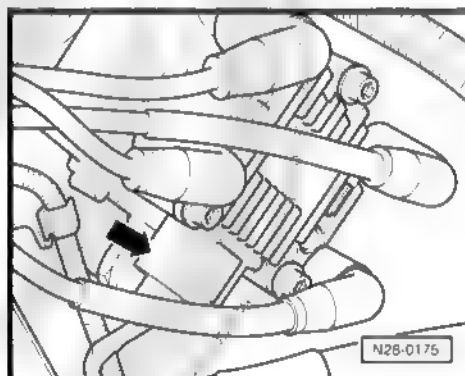
Engines: BAH, BJA, BPA, CCRA, and CFZA



BLH Engine:

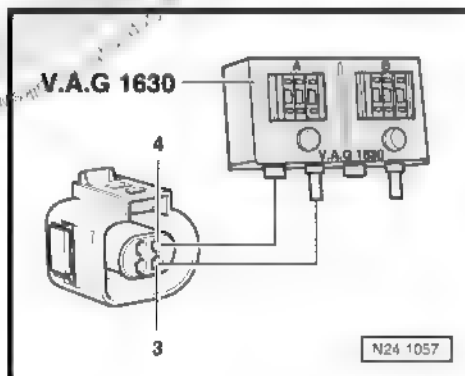


- Disconnect the 4-pole connector from flange Ignition transformer -N152- -arrow-.



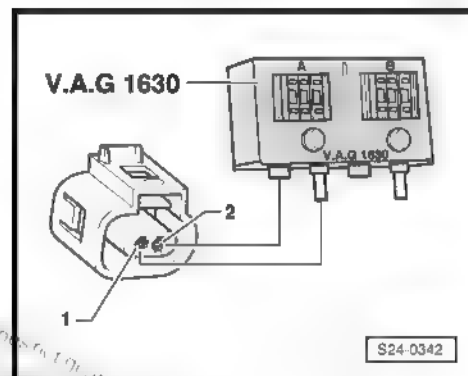
- Connect the Digital potentiometer (included in VAG 1594C) - VAG 1630- with Measurement auxiliary cable set -VAG 1594A- to contacts 3+4 of the connector and adjust the connected side to 15 kΩ.

CCRA Engine





- Connect the Digital potentiometer (included in VAG 1594C) - VAG 1630- with Measurement auxiliary cable set -VAG 1594C- to contacts -1-+-2- of the connector and adjust the connected side to 15 kΩ.
- Disconnect the injection valve harnesses from on the fuel distributor
- Remove from head the complete fuel distributor with all injecting valves (fuel hoses remain coupled).



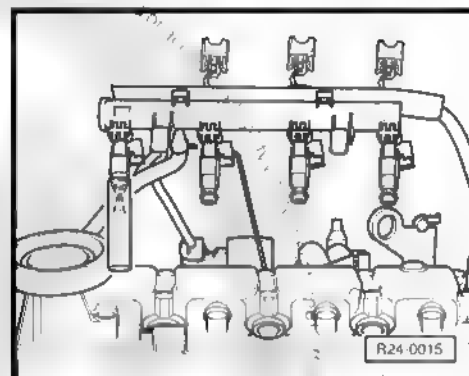
- Keep a small scaled container below the injection valve that shall be tested and remove the connectors from the remaining injection valves.
- A second person must actuate the Starter -B- . The injection valve shall inject in pulses.
- Repeat the test on the other injection valves. Watch that only the injection valve which is being tested is connected.
- Then examine the seal of the injection valves. More than 2 drops per minute shall not drop.

If the fuel loss is greater:

- Turn the ignition off.
- Replace damaged injector valve.

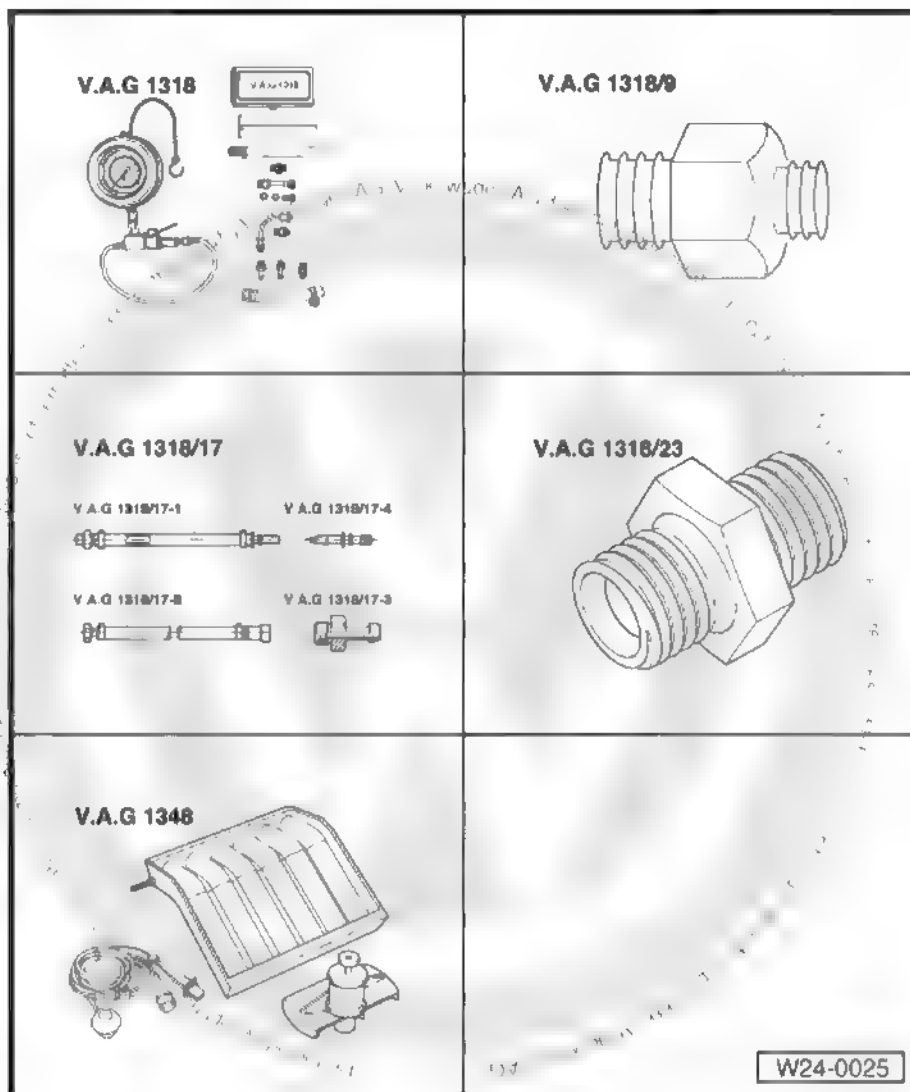
Installation happens in removal reversed order, considering the following:

- ◆ The rings in all injecting valves must be replaced and slightly lubricated with clean engine oil.
- ◆ Insert injecting valves vertically in correct position into fuel distributor, and immobilize with safety fasteners.
- ◆ Install fuel distributor with injecting valves on engine head and press evenly.





2.2 Fuel pressure regulator and remaining pressure - check



Note

- ◆ The fuel pressure regulator adjusts the fuel pressure to 4.2 bar approximately.
- ◆ The fuel pressure regulator is in the fuel pump.

Special tools and workshop equipment required

- ◆ Pressure tester -VAG 1318-
- ◆ Adapter -VAG 1318/1-
- ◆ Adapter -VAG 1318/17-
- ◆ Adapter -VAG 1318/23-
- ◆ Adaptor cable -VAG 1348/3A-

Test sequence:

- Remove the fuse box cover.



- Remove fuse 33 of the fuel system pressurization pump G6 from fuse box.



WARNING

Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure, carefully removing hose and loosening closing bolt.

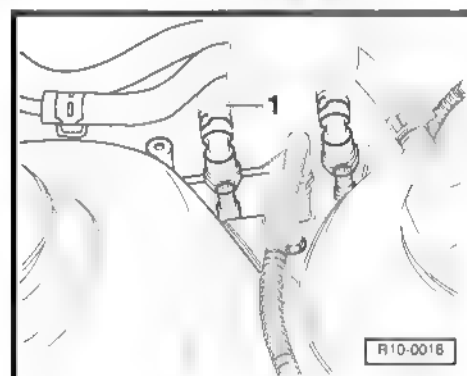
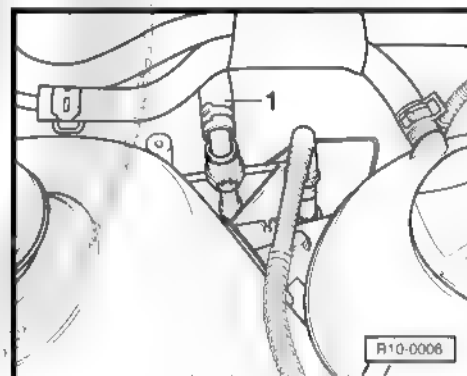
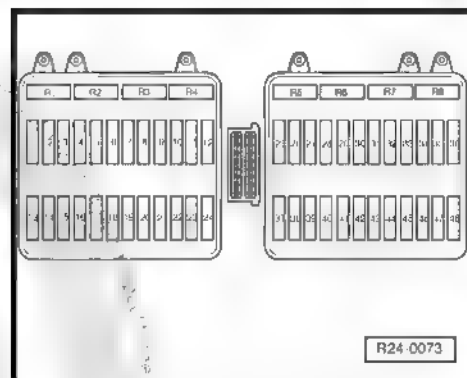
- Disconnect the fuel intake tubing connection -1- and collect any fuel that might leak with a rag. (BAH, BLH, and CFZA engines only).

- Disconnect the fuel intake tubing connection -1- and collect any fuel that might leak with a rag. (BJA, BPA, and CCRA engines only).



Note

To unlock fuel ducts, push safety ring.





- Connect the Pressure tester -VAG 1318- with Adapter set - VAG 1318/17- and Adapter -VAG 1318/9- .
- Open pressure tester shut-off cock. The shut-off cock will indicate the flow direction.
- Replace fuse 33 of the Fuel system pressurization pump -G6- in the fuse box.
- Start the engine and let it idle
- Measure the fuel pressure. Theoretical value: approx. 4.2 bar.

If theoretical value is not reached:

- Turn the ignition off.
- Check if Fuel system pressurization pump -G6- generates and maintains this pressure ⇒ [page 120](#) .
- Check the fuel pressure regulator ⇒ [page 154](#) .

If theoretical value is reached:

- Turn the ignition off.
- Check the seal and retaining pressure by controlling the pressure drop in Pressure tester -VAG 1318- . After 10 minutes, a minimum pressure of 2.0 bar should be reached.

If remaining pressure falls below 2.0 bar:

- Start the engine and let it idle.
- On reaching the pressure, turn the ignition off, and, at the same time, close the shut-off cock of the Pressure tester -VAG 1318- (shut-off cock across flow direction -arrow-).
- Watch the pressure drop on Pressure tester -VAG 1318-.

If the pressure drops again:

- Inspect the retention valve of Fuel system pressurization pump -G6- ⇒ [page 125](#) .
- Check the fuel pressure regulator ⇒ [page 154](#) .



Note

Before removing Pressure tester -VAG 1318- , put rags around hose joints again.

If the pressure does not drop:

- Check the hose connections, rings on the fuel distributor and injection valves for leakages.
- Check Pressure tester -VAG 1318- with regard to leaks.

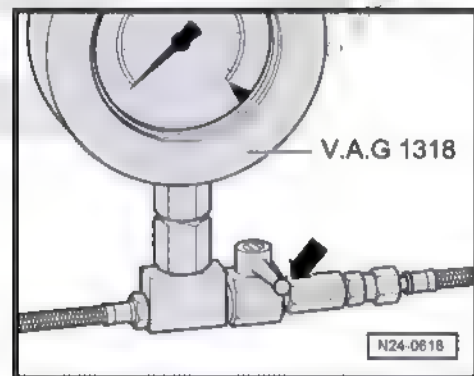
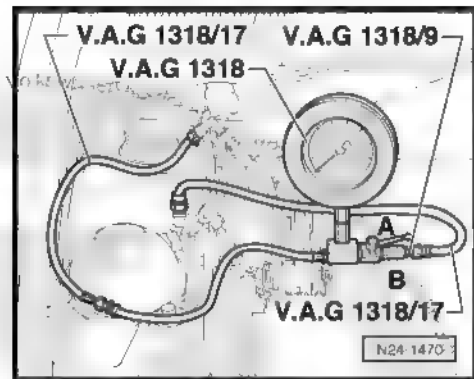
2.2.1 Check the fuel pressure regulator

Test conditions:

- Retention valve of Fuel system pressurization pump -G6- In order: check ⇒ [page 125](#) .

Test sequence:

- Turn the ignition off.
- Separate connector from cylinder 1 injector valve.





- Connect the Remote control -VAG 1348/3A- to cylinder 1 injector valve connector and red clamp at the Battery -A-, positive terminal (+).



WARNING

Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around connections. Next, eliminate pressure removing hose carefully.

- Loosen supply tubing -1- from fuel filter outlet
- Return piping -2- (blue) maintain connected.
- Feed tubing -3- (black) maintain connected.
- Supply tubing (filter outlet to engine) -4- connect to measuring device outlet.



Note

To unlock fuel tubing, push safety ring.

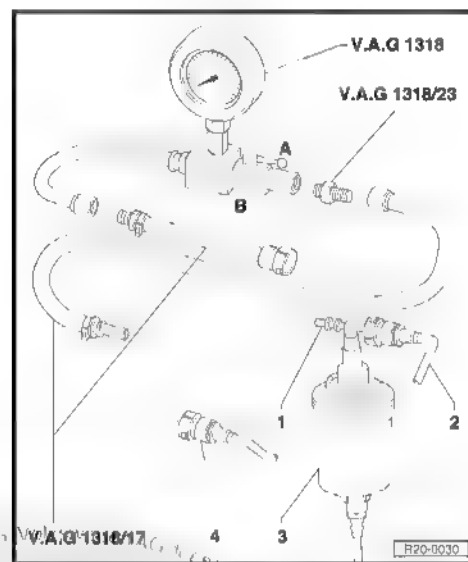
- Connect the Pressure tester -VAG 1318- with Adapter -VAG 1318/23- and Adapter -VAG 1318/17- as indicated.
- Close the shut-off cock of the Pressure tester -VAG 1318- (shut-off cock across flow direction -B-).
- Activate Remote control -VAG 1348/3A- for approximately 10 seconds to fill the fuel filter and produce approximately 4.2 bar of pressure in the system.
- Watch the pressure drop on Pressure tester -VAG 1318-. After 10 minutes, pressure should not drop below 2.5 bar.

If the pressure drops further:

- Ensure pipe connections are not leaking.

If no pipe fault is detected:

- Replace the fuel pressure regulator.





3 READINESS Code

Function

The READINESS Code is an 8 digit code that indicates diagnosis status of exhaust gas.

When a system diagnosis (such as: secondary air system) is successfully accomplished, the corresponding number code digit changes status.

Diagnosis are performed at regularly during normal operation. After repairing the exhaust system it is advisable to generate the READINESS code, in order to assure that systems work as planned. Any fault recognized by diagnosis will be stored in the fault memory.

The READINESS code is erased every time the fault memory is deleted or whenever there is a power failure in the Engine control unit -J623- .

3.1 Read and generate READINESS code

⇒ Vehicle diagnosis, testing and information system VAS 5051



4 Engine control unit -J623-

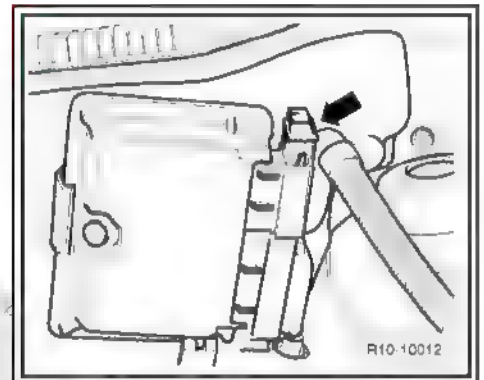
4.1 Engine control unit -J623- - remove and install

- Before removing Engine control unit -J623- first check the identification of the Engine control unit -J623- and by this also the code of the Engine control unit -J623- ⇒ [page 158](#) .

4.1.1 Removal

Engines: BAH, BLH, BJA, and BPA

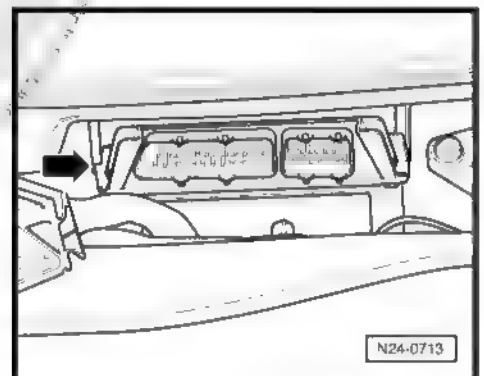
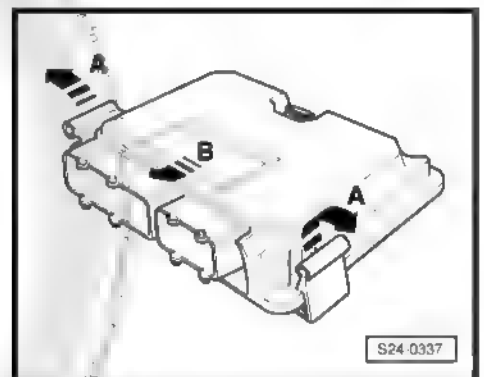
- Turn the ignition off.
- Disconnect the fitting connector-arrow- from the Engine control unit -J623- and remove it.



- Press the clamps -arrows- out and pull Engine control unit -J623- to the side.

Engines: CCRA and CFZA

- Remove the blade shafts and the lower windshield trim: ⇒ Electrical system; Rep. Gr. 92 ; Windshield wiper and washer, rear window and headlights .
- Unlock the connectors of the Engine control unit -J623- and disconnect them:
- Push Engine control unit -J623- to the right -arrow- and remove it.

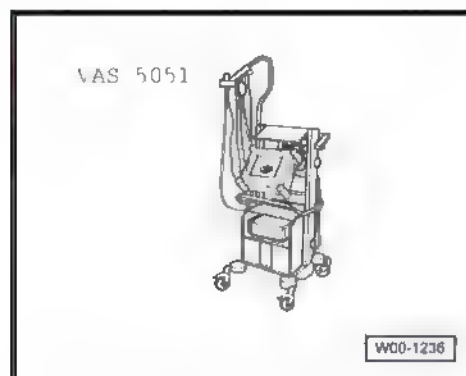


4.1.2 Installation

- Position the new Engine control unit -J623- and press it to the left
- Connect the connector and lock it.



- Adjust Engine control unit -J623- ➔ [page 158](#)
- Check the fault memory for the new Engine control unit -J623- and, if necessary, erase the fault memory ➔ [page 158](#).
- Perform test cycle.
- Once again, check the fault memory for Engine control unit -J623-.



4.2 Fasten components

Special tools and workshop equipment required

- ◆ Diagnosis, Measurement and Information System -VAS 5051A/52-.
- ◆ 5m-replacement cable -VAS 5051/3- or Diagnostic cable -VAS 5051/1-

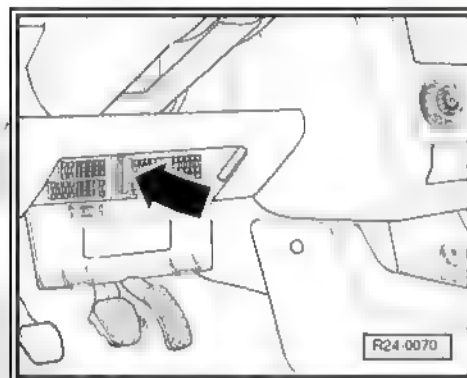
Sequence of operations:

- Connect the Diagnosis, Measurement and Information System -VAS 5051A/52- as follows:
- Connect the cable connector Diagnostic cable -VAS 5051/1- or 5m-replacement cable -VAS 5051/3- to the diagnostic connection.

Select, on Diagnosis, Measurement and Information System -VAS 5051A/52- nd "Guided fault location".

After consulting all command units:

- Press the **Skip**.
- Select **Function/component selection**.
- Select **actuation**.
- Select **engine identification codes**.
- Select **systems with self-diagnosis**.
- Select **engine control**.
- Select **functions**.
- Select **function or component**.

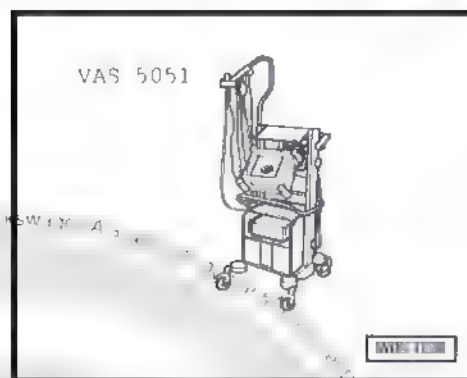


4.3 Consult fault memory of the Engine control unit -J623- and erase

Special tools and workshop equipment required



- ◆ Diagnosis, Measurement and Information System -VAS 5051A/52- -VAS 5051-



- ◆ 5m-replacement cable -VAS 5051/3- or Diagnostic cable -VAS 5051/1-

Sequence of operations:

- Connect the Diagnosis, Measurement and Information System -VAS 5051A/52- as follows:



- Connect the Diagnostic cable -VAS 5051/1- or 5m-replacement cable -VAS 5051/3-.
- Start the engine and let it idle

Only if engine does not start operating:

- Turn the ignition on.

Select operation type:

- Press on the display **Vehicle self-diagnosis**.
- Press on the display **Self-diagnosis**.
- Press the **[]**.

The display will show command unit identifications and the coding of the Engine control unit -J623-.

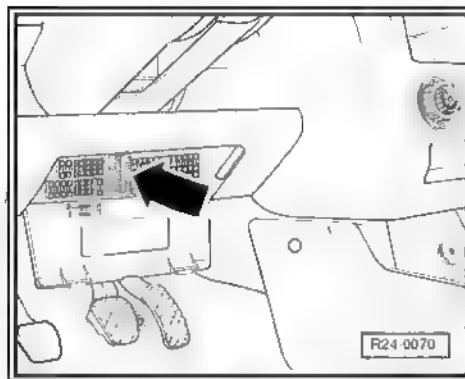
Select the vehicle system:

- Press on the display **01 Engine electronics**.
- Press the **[]**.

Selecting diagnosis function:

- Press on the display **004 Fault memory content**.
- Press the **[]**.
- Press on the display **004.01 Check fault memory**.
- Press the **[]**.
- In case there are no faults stored in the Engine control unit -J623-, the display will inform "0 faults detected".
- In case there are faults stored in the Engine control unit -J623-, these will be shown in sequence by the display.
- Press the **[]**.
- Press on the display **004.10 Erase fault memory**.
- Press the **[]**.
- Press the **[]**.
- Press the **Cancel/Finalize**.

If the operation is cancelled, touch Cancel, if the operation is finalized, touch Finalize.





26 – Exhaust system

1 Removal and installation of the exhaust system parts



Note

After installing the exhaust system, ensure that the system is tension-free and and clearance to the body is sufficient. If necessary, loosen the double clamp (or clamps) and separate the muffler and the exhaust pipe so that they are sufficiently away from the body at their full length and that the brackets evenly support their weight.



WARNING

Always replace self-locking nuts and screws which were subjected to angular torque.

1.1 Exhaust manifold, front exhaust pipe with catalyst and attachments

Engines BAH, BLH, BJA and BPA



1 - Thermal deflector

2 - 10 Nm

3 - Exhaust manifold

4 - Seal gasket

☐ Replace

5 - Self-locking nut

☐ 25 Nm

☐ Renew each time after removing

6 - Double clamp

7 - To the intermediate muffler

8 - Self-locking nut

☐ 40 Nm

☐ Renew each time after removing

9 - Front exhaust pipe with catalyzer

10 - Bearing support

☐ Replace if damaged

☐ Remove using Hook - VW 5812-

11 - Fitting connector

☐ Only for the BLH engine

☐ Black, 4 poles

☐ For Lambda probe after catalytic converter - G130-

12 - Lambda probe after catalytic converter -G130-

☐ 50 Nm

☐ For the BLH engine only.

☐ Only lubricate the thread with High temperature paste -G 052 112 A3- ; High temperature paste -G 052 112 A3- cannot reach the body trims of Lambda probe after catalytic converter -G130- .

☐ Remove and install with Socket kit for Lambda probe -3337- .

☐ Remove sealing ring in the event of leaks and replace it.

13 - Fitting connector

☐ Black, 4 poles.

☐ For Lambda probe -G39- before the catalyzer and Lambda probe heating -Z19-

14 - Lambda probe -G39- before the catalyzer

☐ 50 Nm

☐ Only lubricate the thread with High temperature paste -G 052 112 A3- ; High temperature paste -G 052 112 A3- cannot reach the body trims of Lambda probe -G39- .

☐ Remove and install with Socket kit for Lambda probe -3337- .

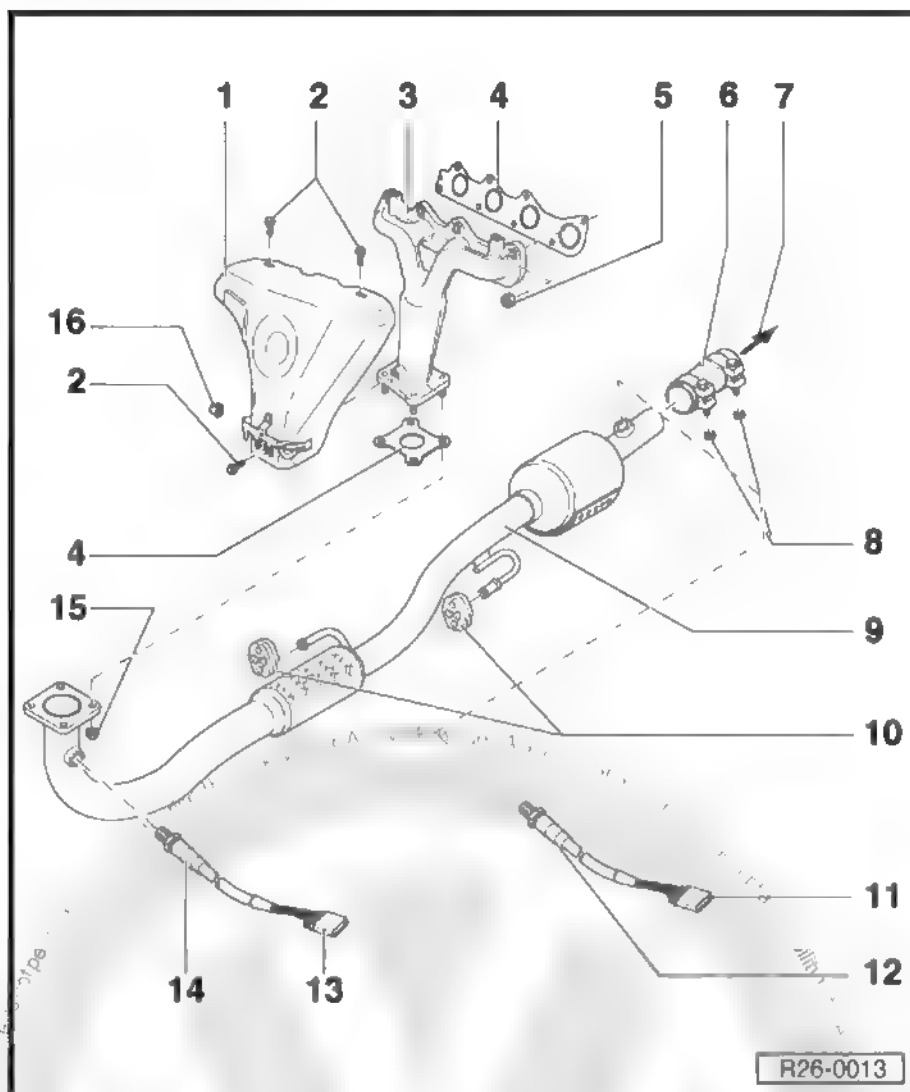
☐ Remove sealing ring in the event of leaks and replace it.

15 - Self-locking nut

☐ 40 Nm

☐ Renew each time after removing

16 - Clip





Engines: CCRA and CFZA

For this engine, models manufactured as from model-year 2011
are equipped with Lambda probe after catalytic converter -G130- .

1 - Heat deflector

2 - 10 Nm

3 - Exhaust manifold

- ☐ For removal, remove the heat deflector and loosen front exhaust pipe
- ☐ Torque for fastening nuts 25 Nm.
- ☐ Replace after removing self-locking nuts

4 - Lambda probe -G39- before the catalyzer,

- ☐ 50 Nm
- ☐ Only lubricate the thread with High temperature paste -G 052 112 A3- ; High temperature paste -G 052 112 A3- cannot reach the probe body's trims.
- ☐ Remove and install with Socket kit for Lambda probe -3337- .
- ☐ Remove sealing ring in the event of leaks and replace it.

5 - Seal gasket

- ☐ Replace.

6 - Catalyzer unit

- ☐ Built into the exhaust pipe manifold.

7 - Double clamp

8 - To the back muffler

9 - Self-locking nut

- ☐ 40 Nm
- ☐ Renew each time after removing.

10 - Front exhaust pipe tube with intermediate muffler

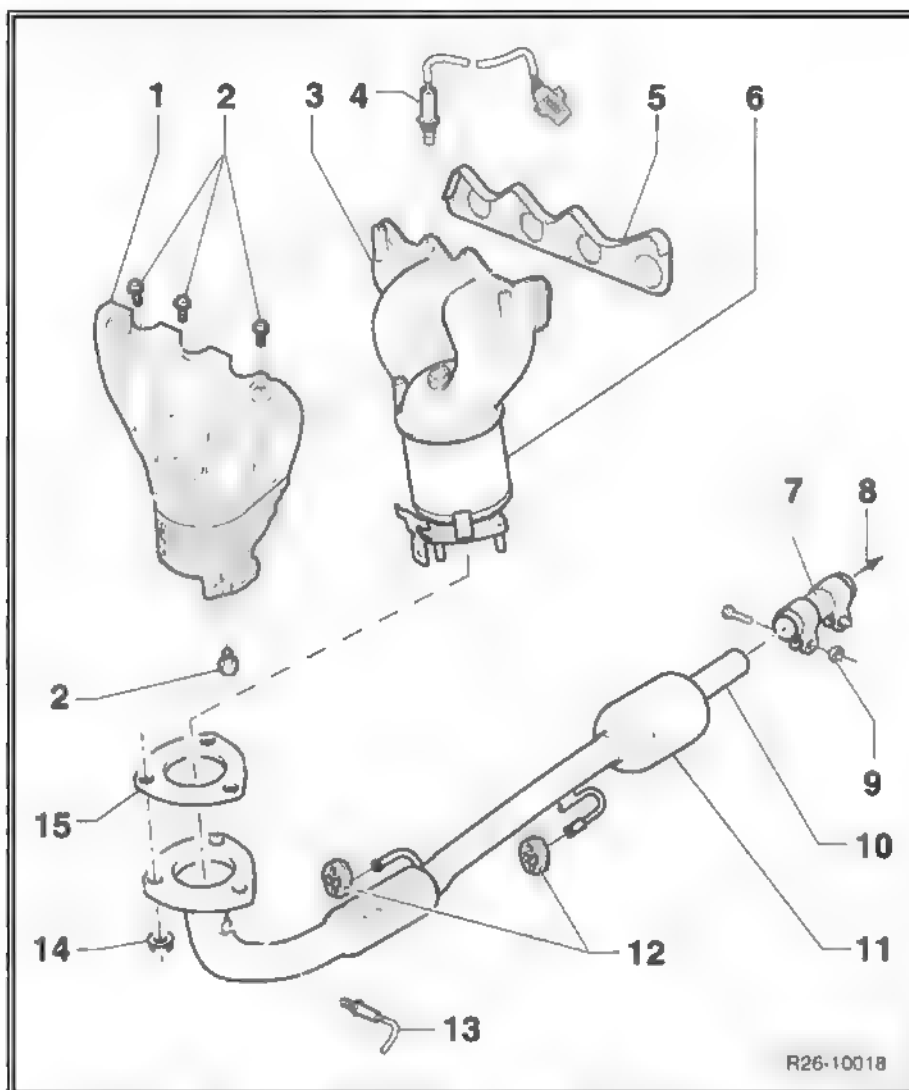
11 - Intermediate muffler

12 - Support strap

- ☐ Renew if damaged
- ☐ Remove with Hook -VW 5812- .

13 - Lambda probe after catalytic converter -G130-

- ☐ 50 Nm
- ☐ Only lubricate the thread with High temperature paste -G 052 112 A3- . High temperature paste -G 052 112 A3- cannot reach the probe body's trims
- ☐ Remove and install with Socket kit for Lambda probe -3337- .
- ☐ Remove sealing ring in the event of leaks and replace it.





- ☐ Only for Suran model produced as from model-year 2011.

14 - Self-locking nut

- ☐ 40 Nm
- ☐ Renew each time after removing

15 - Seal gasket

- ☐ Replace

1.2 Muffler with supports

1 - Bearing

2 - Intermediate muffler

- ☐ Only for BAH, BLH, BJA and BPA engines

3 - 25 Nm

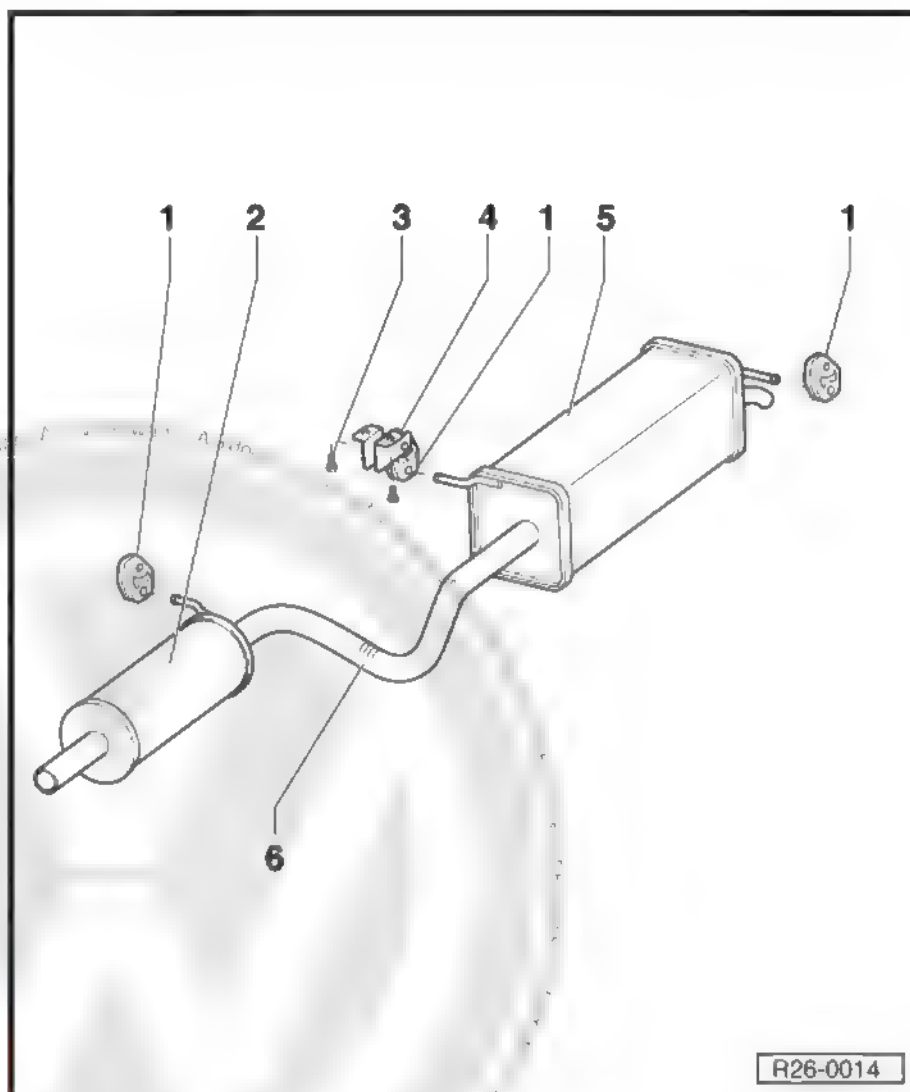
4 - Support

- ☐ Secured to body.

5 - Rear muffler

6 - Separation point

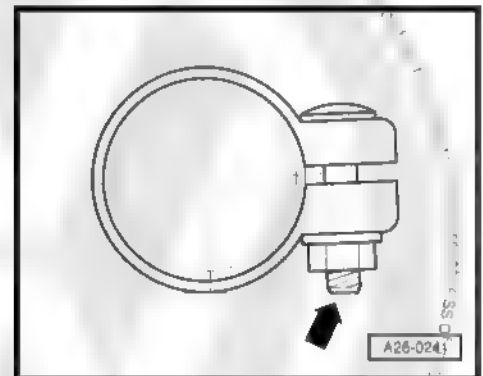
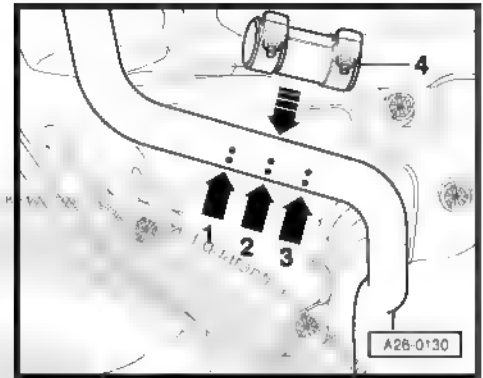
- ☐ Identified through depressions on linking tube.
- ☐ The intermediate and rear muffler are mounted in series as one piece. For repairs, intermediate muffler and rear muffler are separately provided, with double brace for repair.
- ☐ Cut the connection tube at the separation point with Pneumatic Saw or EQ 7415 -VAG 1523A- or Tube cutter -VAS 6254- for example, in a straight angle
⇒ [page 165](#)





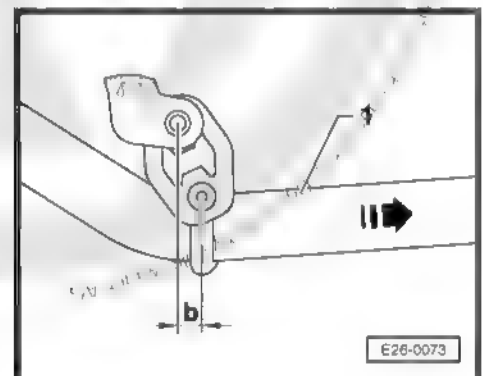
Separation point on the exhaust pipe

- Cut the exhaust pipe in a right angle on the separation point -arrow 2-.
- Apply the Sealant for exhaust pipe connections -D 004 500-
=> See Chemicals Manual. on the junctions and next, assemble the sleeve and clamps on the exhaust pipe.
- Position the double clamp for repair -4- during installation, on the lateral identifications -arrow 1- and -arrow 3-. Tightening torque: 40 Nm
- Install the double clamp in such a manner as for the tip of the screw to not extend beyond the inner edge of the double clamp.



Support bearing position

- Distance -b- between the clamp and the exhaust tube support should be about 8 mm.
- A -arrow- shows the front portion of the vehicle.





28 – Ignition system

1 Ignition system: Repair

1.1 General indications about the ignition system

- ◆ This chapter addresses especially components related to the ignition system. Other components of the injection and ignition system ⇒ [page 132](#) .
- ◆ Minimum voltage of 11.5V V is necessary for the perfect operation of electric components.
- ◆ In a few tests, Engine control unit -J623- can only detect and memorize one fault. After finishing all tests and repairs, the fault memory must be consulted and, if necessary, deleted ⇒ [page 158](#) .
- ◆ If after faults are found, components are repaired or inspected, the engine starts and then turns off immediately thereafter, Immobilizer control unit -J362- might be blocking Engine control unit -J623- . In this case, refer to the fault memory and, if necessary, adjust Engine control unit -J623- ⇒ [page 158](#) .

Safety measures ⇒ [page 168](#) .

Checking data, spark plugs ⇒ [page 168](#) .

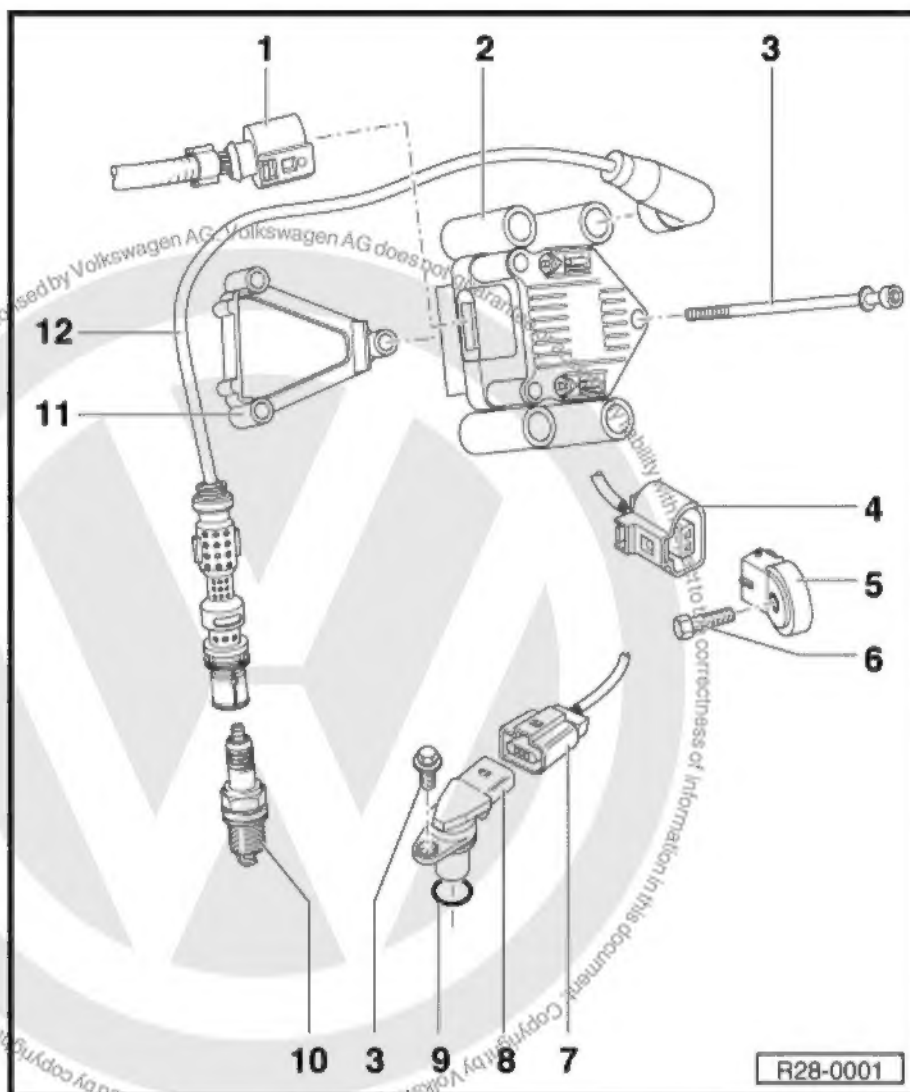
1.2 Injection system components - remove and install



Note

*Engine speed sender -G28- with connectors
⇒ [Item 7 \(page 133\)](#) .*

- ☐ With interference suppressor and connector for Spark plugs -Q-
- ☐ Resistance 4.8...7.2 kΩ.





1.3 Safety measures

In order to avoid personal injury and/or deterioration of the injection and ignition system, observe the following:

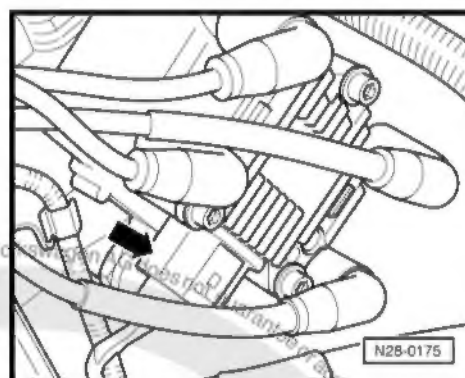
- ◆ Do not touch or disconnect the ignition cables while the engine is running or at start speed.
- ◆ Loosen and connect injection and ignition system cables, including cables of measuring equipment, only with ignition off.

If during a test cycle it is necessary to use test and measuring equipment, consider the following:

- ◆ Test and measuring equipment must be placed on the back seat to be used by a second mechanic from there.

If test and measuring equipment are operated on passenger seat, person seating there may be injured due to airbag activation in case of accident.

- ◆ In case one wishes to run the engine with start rotation without operating:
 - Disconnect the 4-pole connector from flange Ignition transformer -N152- -arrow-.

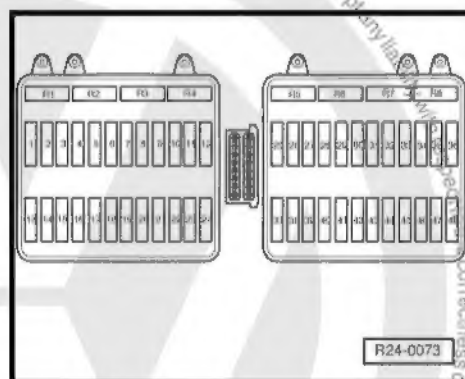


- Remove fuse 33 from fuse box.



Note

When fuse 44 is removed, power supply to injectors is interrupted.



1.4 Test data, spark plugs

Engine identification letters	BAH/BLH/CFZA	BJA/BPA	CCRA
Firing order	1-3-4-2	1-3-4-2	1-3-4-2
Spark plugs ^{21) 22) 23)}	101/905609// or 101/905608//	101/905601/C/ or 101/905617/A/	101/905610//C or 101/905625//
Manufacturer	BOSCH or NGK	BOSCH or NGK	BOSCH or NGK
Manufacturer designation	FL7HTCOR or BKUR5ETC-10	F6HER2. or ZFR 6 P-G	F5DER2 or BKR7ESB
Electrode distance	max. 0,9... 1.1 mm	max. 0.8...0.9 mm	max. 0,8... 0.9 mm
Tightening torque	30 Nm	30 Nm	30 Nm



21) Current values as well as replacement intervals for Spark plugs -Q- : ➔ Emissions test folder.

22) Remove and install Spark plugs -Q- with Plug spanner -3122B- .

23) Remove and install spark plug connectors with the Assembly tool -T10029-

05.11

